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The American Speech and Hearing Association
THIRTY-FIRST ANNUAL CONVENTION
November 17-19, 1955, Hotel Statler, Los Angeles

FORMAL CALL FOR PAPERS

THIS INVITATION is being issued to all members of the Association to submit abstracts of papers which they wish to have considered for presentation on the program at the Annual Convention in 1955. All proposals must be in the form of an abstract; titles alone cannot be considered. Members who do not have a paper to give, but who wish to make program suggestions are strongly urged to forward these to the Program Committee. Abstracts or program suggestions should be sent to James Carrell, Speech and Hearing Clinic, University of Washington, Seattle, Washington. Nonmembers may submit abstracts, but these must be sponsored by a member.

Abstracts will be accepted until *May 15*, but members are urged to forward their proposals as far in advance of that date as possible. Program suggestions must be sent in at once if they are to receive adequate consideration.

The abstract should indicate (1) the full title of the paper, (2) the name of the contributor and his professional affiliation, (3) a summary of the content of the paper, (4) the time required for presentation and (5) details on any equipment needed for presentation. It is recommended that papers be planned so that no more than 12 minutes will be required for their presentation. Longer papers will be considered, but can be accepted only if they are of unusual interest or significance.

Papers are invited on all aspects of the speech and hearing processes and human communication. They may deal with *fundamental theoretical work* in these fields, report *experimental or clinical studies* of the speech and hearing processes and their disorders, describe *practical techniques in speech and hearing diagnosis and therapy* or be concerned with *professional problems and procedures.*

The committee hopes to make a place on the program for a large majority of the submitted papers. We wish to emphasize that the submission of worth-while papers is not only a privilege but a professional obligation of members of the Association. The quality of the program will depend primarily upon the kind and number of papers offered for the consideration of the program committee.

Submission of an abstract implies that the contributor accepts the following responsibilities: (1) He must be present in person at the scheduled time. If unforeseen circumstances prevent his attendance, he must notify the chairman of his section meeting as far in advance as possible. (2) He must keep strictly within the time limits indicated on the printed program, and should assure himself *in*

advance that this can be done. (3) He must make certain that his material is organized in a manner suitable for *oral* presentation. (4) He must be sure that all visual aids (slides, films and the like) are of such a nature that they are adequate for the conditions which typically exist in the rooms in which section meetings are held.

It is the hope of the committee that the 1955 convention program will be of high quality and sufficiently varied to meet the wishes of the various special interest groups who make up the Association. Your cooperation is needed in meeting these objectives.

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The Information Of Sounds And Phonetic Digrams Of One- And Two-Syllable Words

John W. Black

KNOWLEDGE OF the statistics of the English language is limited and the scope of the topic forbidding. Inroads are exemplified by the works of Thorndike (*18, 19, 20*), Dewey (*6*), and Pratt (*14*). Thorndike's concern was the frequency of usage of the word in printed language of 'common knowledge.' Other tabulations of words are available, most of them word counts of the language of special groups, particularly of age levels (*1, 4, 5, 7, 8, 9*). This approach to language, aside from an applied connotation, focuses upon the probability of a word.

Dewey added phonetic tabulations or, 'sound counts,' and syllable tabulations to an enumeration of the frequency of common words. His work formed the basis for the development of a system of shorthand. As Morse code devotes minimum space to the frequent letter *e*, so efficient transcribing of acoustic language by shorthand is facilitated when simple characters represent the most frequent units of speech. Voelker (*21, 22, 23, 24, 25*) added relevant studies that were less extensive than Dewey's. These investigations permit statements of the probability of speech sounds.

Pratt, in the context of cryptography, emphasized the aspect of probability with respect to letters in printed English. In addition to the frequency of single letters and their occurrence in initial and terminal positions in words, he determined the relative frequency of digrams and trigrams and enumerated the more frequent trigrams.[1]

Among other approaches to the statistics of language, Newman and Gerstmore (*13*) applied autocorrelation techniques to the vowel-consonant sequences and Lotz (*11*) and Menzerath (*12*) developed graphical representations of 'frequency of occurrence.' Information theory (*17, 26*) provides another technique for quantifying language. This methodology includes (a) a unit of measure-

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[1]Pratt used *bigram* to denote a pair of letters. *Digram* is in current use. *Digram* may seem to have appropriateness for written language, not spoken language. The word has been accepted by electrical engineers, however, in reference to pulses, etc. Since the meaning of *digram* has already been 'extended,' since *diphthong* is not available for the present meaning and a new word such as *biphthong* would be cumbersome, *digram* is used here to mean *two sounds*.

ment, the *bit*, (b) a point of view that is intuitively valuable, 'the reduction of uncertainty,' and (c) a mathematical treatment. The receiver or listener is viewed as being in a state of uncertainty about which symbol of a prescribed set he is to receive. If the symbols (sounds, letters, words, etc.) contribute equally to reducing this uncertainty, the symbols will be operating at the limit of their possibilities insofar as information transmission is concerned. This high efficiency of information transmitted per symbol could obtain only with independence among the symbols, i.e., with no 'intersymbol influence,' and if the symbols did occur with equal probability there would be no intersymbol influence. A circumstance in which each symbol of the collection of symbols has an equal opportunity of occuring next does not obtain in any aspect of English: letters are not equally frequent, sounds are not equally probable, some words do not ordinarily follow other words, etc. Information theory assesses information per symbol as the amount by which uncertainty is reduced on the average on receiving the symbol. The quantitative difference between the maximum information per symbol and the actual information per symbol, divided by the maximum information per symbol, is called redundancy. With no redundancy in the language, each symbol would occur with equal probability; and as the intersymbol influence increases or the probability of one symbol approaches unity, the redundancy of the language approaches a maximum value of unity.

Problem

The present study is a 'finger exercise' in applying elementary techniques of information theory to phonetic probability. One- and two-syllable isolated words were sampled with respect to (a) the relative frequency of speech sounds, $p\ (i)$ (to be read 'the probability of sound *i*'), (b) the relative frequency of occurrence of the sounds at different positions in the word, (c) the probability of two sounds occurring in succession, $p\ (i,j)$ (to be read 'the joint probability of a sequence of sounds designated *i* and *j*'), (d) the probability that one sound follows another, $p_i\ (j)$ (read 'the conditional probability that sound *j* follows sound *i*'), and (e) probability that a sound will precede another, $p_j\ (i)$ (read 'the conditional probability that sound *i* precedes sound *j*').[2] Words of one and two syllables and of differing numbers of sounds were treated separately. The principal objective was to estimate the information of sounds and digrams. This would lead to an estimate of the redundancy that might be ascribed to the phonetic structure of words. A secondary objective was enumerative, to find the probability of the sounds and digrams represented by the sample.

The narrowness of the problem is emphasized. The sample was not continuous language and it might be regarded as *zero-order approximation* to the language of speech, i.e., an array of words not weighted by their

[2]At first thought, it may appear that values *d* and *e* should be identical. An analogy will make the disparity clear. In ordinary spelling, $p_i\ (j)$ equals unity when the *i-symbol* is the letter *q* and the *j-symbol* is the letter *u*, for *q* is always followed by the letter *u*, as in *quay, quiet*, etc. As one 'reverses his field,' however, and starts backward from the letter *u*, he finds that many letters may precede it, as *lute, rule*, etc. Thus, $p_j\ (i) < 1$ when the letter *u* is the *j-symbol*.

probability. In contrast, the studies cited above (e.g., *6, 11-14, 18-25*) involved *first-order approximations* to language, words weighted by their frequency of occurrence. Thus, interpretation and application of the

TABLE 1. The proportions of initial, 'medial,' and final positions of words of different lengths that contain the indicated sound. The proportions appear separately for one- and two-syllable words. Read as chances in 100.

	Initial		*Medial*		*Final*	
	1-syllable	*2-syllable*	*1-syllable*	*2-syllable*	*1-syllable*	*2-syllable*
i	0.20	0.37	4.10	2.12	0.60	0.09
ɪ	0.50	4.80	7.50	10.71		9.16
e eɪ	0.30	0.37	4.60	2.53	1.30	1.92
ɛ	0.50	1.02	5.80	3.93		
æ	0.50	1.07	7.20	3.97	0.10	
ɑ	0.50	0.84	4.50	2.79	0.10	0.09
ɔ	0.10	0.79	3.90	1.78	0.50	0.05
o oʊ	0.40	0.88	4.10	2.08	0.80	1.59
ə		3.96		5.17		0.51
ʌ	0.10	0.37	5.50	2.25		
ɚ ɝ r ɻ	4.70	6.56	15.30	10.06	3.60	16.87
u	0.10		3.20	1.46	0.80	0.42
ʊ			0.30	0.17		
ɔɪ	0.10	0.14	0.50	0.20	0.30	
aʊ	0.10	0.51	1.90	0.61	0.30	0.05
aɪ	0.10	0.28	3.90	2.28	1.20	0.56
ju	0.10	0.14	0.30	0.46	0.10	0.23
p	6.80	8.10	2.40	2.69	5.80	0.79
b	8.60	6.98		1.78	2.00	0.61
t	6.60	4.75	2.60	5.75	17.20	14.49
d	5.00	6.05	0.20	2.86	8.80	6.82
k	9.10	8.52	2.10	3.83	8.70	2.48
g	6.20	2.93	0.10	1.17	2.20	0.19
f	7.00	5.87	0.20	1.75	2.60	0.70
v	1.40	1.77	0.20	1.44	2.70	1.03
θ	1.80	0.79		0.32	2.60	0.56
ð	0.50	0.33		0.32	0.30	0.05
s	16.90	10.57	2.80	4.46	6.20	8.27
z	0.10	0.19	0.10	0.94	3.50	2.06
ʃ	3.00	0.74		0.79	1.90	1.17
ʒ		0.05		0.09		
h	4.70	4.05		0.27		
tʃ	1.70	0.88		0.43	3.90	0.33
dʒ	1.30	0.88		0.64	2.60	1.96
m ṃ	3.60	5.35	1.30	3.06	4.80	2.34
n ṇ	2.40	1.77	5.10	7.12	6.50	10.93
l l̩	4.90	3.91	7.20	5.86	6.20	11.59
w	3.80	2.89	1.90	0.92		
hw	0.80	0.42		0.07		
j	0.60		2.00	0.23		
ŋ			1.20	0.66	1.90	2.01

present results are limited to matters pertaining to single words, for example, words that are sometimes enumerated as oral drills, singularly loaded with a phoneme in three positions: initial, final, and 'medial.' Should the drill-maker wish to employ probable and improbable phonetic environments for the phoneme, based on an unweighted population of 'root' words, the present material would be relevant.

Procedure

The sample of words included 1549 of one syllable and 2151 of two syllables. They had been selected from words of Thorndike ratings 1-10 through excluding homonyms, homographs, and words of greatest and least intelligibility (included: >20% <80% when heard through headsets in high-level noise and recorded as write-down items). The sample was available with the phonetic spellings entered on IBM cards (*2*). The representativeness of the selected sample with reference to the Thorndike list was checked in some particulars. For example, the proportion of initial *letters* had not been altered beyond 'chance.' Words of two sounds among one-syllable words and words of seven or more sounds among two-syllable words, however, were disproportionately infrequent. The principal analyses were applied to five categories of words, designated by an asterisk in the following summary of the sample:

Sounds	*1-Syllable*	*2-Syllable*
<3	91	....
3	679*	47
4	628*	528*
5	151	765*
6	....	555*
>6	....	256

A major limitation of the sample would seem to lie in the fact that the words were only root forms, present tense, etc.; no plurals, etc.

Three students of speech transcribed the words phonetically; two had taught phonetics. All used General American pronunciation. The work of each transcriber was reviewed by the remaining two. The 49 sounds that were used are indicated in Table 1. They included four syllabic sounds, [l̩ ɹ̩ m̩ n̩]; these reduced the *shwa's* of the alternative transcriptions [əl ər əm ən]. Subsequently, because of small numbers of entries in some cells the populations of some related sounds were pooled: all sounds of an *r* character [r ɚ ɝ ɻ]; [eɪ e]; [oʊ o]; [l l̩], [m m̩], and [n n̩], reducing the categories to 41. The IBM cards were dichotomized by *syllables*, sub-sorted according to *number of sounds*, sorted within each category for the *presence of each sound*, and re-sorted for each sound adjacent to each other sound.

The procedures of information theory assume that a sample is representative of an infinite population. This assumption is rarely fulfilled in studies of language. For example, in a study of vocabulary involving nearly a third of a million words uttered by college students in classroom speeches, one-third of the 6000 different words were used only once (*1*).

In a sample of continuous speech each sound would be both an *i*-sound and a *j*-sound in successive digrams. The transcription of running speech would either include a space at the end of a word, however, or reserve the space for arbitrarily defined pauses. The space might be treated as a symbol in which case each sound would be, as stated above, both *i*

TABLE 2. Model for arranging the raw scores for the computational procedures.

Sound (i)	Sound (j) following sound (i)					
	1	2	3	(j)	41
1	n_{11}	n_{12}		n_{1j}	$n_{1(41)}$
2					
3					
(i)	n_{i1}			n_{ij}	$n_{i(41)}$
41	$n_{(41)1}$			$n_{(41)j}$	$n_{(41)(41)}$

and j at different times.[2] This condition would obtain if the discreteness of each word were preserved. For example, in a three-sound word only the first two sounds can be i's and the last two j's and only one sound can be both i and j in treatments of the digrams. This might be called an *end* problem and it occurs with each word in the population. In the word *top*, [tɑ] and [ɑp] are (i,j) digrams but there is no opportunity for [t] to be j nor for [p] to be i if the word is treated singly. Thus, in determining the average information of digrams, the number of sounds from which the (i,j) digrams were derived in each category of words was *number of phonemes in the words* minus the *number of words of the category*.

[2]During the writing of this paper the author has received from John B. Carroll (*3*) a progress report on a study of probabilities of English phonemes. He treats a sample of continuous language with a space or 27th letter occurring between successive words.

Shannon (*15*) retained the identity of the word in his work, noting, 'A word is a cohesive group of letters with strong internal statistical influences. . . .' A consequence of this treatment is the possibility that information values of i's and j's will differ if sounds occur with differing frequencies in initial and final positions.

A model for arranging the raw scores for the computational procedures relative to each category of words is shown in Table 2. Four probabilities were determined with respect to each category of words:

$$p_j(i) = \frac{n_{ij}}{\sum_i n_{ij}} \qquad (1)$$

$$p_i(j) = \frac{n_{ij}}{\sum_j n_{ij}} \qquad (2)$$

$$p(i,j) = p(i)p_i(j) \qquad (3)$$

$$p(i) = \frac{\sum_j n_{ij}}{\sum_i \sum_j n_{ij}} \qquad (4)$$

Results and Discussion

Two objectives were stated above: (a) to estimate the information in the sounds and digrams of words, and (b) to enumerate certain phonetic probabilities.

A method of estimating average information suggested by Shannon (*15*, *16*) may be applied progressively through (a) 'a circumstance of no intersymbol influence,' (b) a condition that represents the frequency of each symbol, (c) . . . of each digram, (d) trigram, etc. In his notation, F_0, F_1, and F_2 represent successive estimates of H, each succeeding one determined from a more complete ac-

count of the statistics of the language. Thus, in the present application, F_0, F_1, and F_2 appraise respectively (a) equal probability of all sounds, (b) observed probability of all sounds, and (c) observed probability of all sounds in digrams. The relevant formulas for determining the average information per symbol follow, with illustrative computations to indicate that with no intersymbol influence and with equally probable sounds, the solutions for *b* and *c* would yield the same value as *a*.

$$F_0 = \log_2 N \text{ or} \quad (5)$$
$$= -\log_2 \frac{1}{41} = 5.35 \text{ bits per sound}$$

$$F_1 = -\sum_i p(i) \log_2 p(i) \text{ or} \quad (6)$$
$$= 41(.1306) = 5.35 \text{ bits per sound}$$

$$F_2 = -\sum_{i,j} p(i,j) \log_2 p\ (j) \quad (7)$$
$$= -\sum_{i,j} p(i,j) \log_2 p\ (i,j) + \sum_i p(i) \log_2 p(i)$$
$$= 41^2\ (0.00637) - 41(0.1306)$$
$$= 10.70 - 5.35 = 5.35 \text{ bits per sound}$$

The foregoing computations illustrate the application of three of Shannon's formulas for the calculation of average information per symbol. The maximum average information per digram would be double the value per sound, $2(5.35) = 10.70$ bits. In order to maintain a basis for easy comparison, however, the present results are stated as *average information per sound*.

To the extent that the sounds of the present samples do not occur equally the average information per symbol is attenuated from 5.35 bits. Formula *6* above was applied to both the *i* and *j* sounds *of the digrams* of the words of each category.[4] First, the formula was applied as written, and then was altered through substituting *j* for *i*. The average information per sound in bits follows: H or F_1 =

	one-syllable words	
	i-sounds	*j-sounds*
3-*sound*	5.04	4.65
4-*sound*	4.15	4.40
	two-syllable words	
	i-sounds	*j-sounds*
4-*sound*	4.68	4.31
5-*sound*	4.48	4.15
6-*sound*	4.40	4.33

The redundancy that is indicated by these values of information is:

	one-syllable words	
	i-sounds	*j-sounds*
3-*sound*	.06	.13
4-*sound*	.22	.17
	two-syllable words	
	i-sounds	*j-sounds*
4-*sound*	.13	.19
5-*sound*	.16	.22
6-*sound*	.18	.19

Shannon explains that the information of a digram is either equal to or less than the sum of the information of each of the symbols of the digram. Equality can obtain only in the event of no intersymbol influence as in the illustrative computation in Formulas *6* and *7* above. Thus, the average information per symbol in the digrams of three-sound words would be expected to be less than $\frac{5.04 + 4.65}{2}$, or 4.85 bits. Computations of the information of the digrams yielded the

[4] An earlier discussion explained that the numbers of each sound treated as 'digram-sounds' were attenuated because of the *end* problem. For the sake of comparison, however, all of the sounds of all categories of words were pooled and the average information per sound determined. This yielded 4.46 bits per sound.

following average information per symbol: F_2 as an estimate of H =

	One-syllable words	*Two-syllable words*
3-*sound*	4.21	....
4-*sound*	3.35	3.89
5-*sound*	....	3.89
6-*sound*	....	3.75

The redundancy associated with these values is:

	One-syllable words	*Two-syllable words*
3-*sound*	.21	....
4-*sound*	.37	.27
5-*sound*	....	.27
6-*sound*	....	.30

First, the trend is obvious, both in the calculations of the average information per sound of the digrams and of the digrams themselves, that the symbols of the 'shorter' words convey more information than do those of the 'longer' words.

Second, in four of the five instances the average information per sound was greater when computed on the basis of going from 'sound *i* to the following sound *j*' than *vice versa*. In the 'on-going' circumstance the final sounds of the words were by definition *j*'s and never *i*'s; in the 'backward-looking' instance the initial sounds were only *i*'s and never *j*'s. Thus, one might conclude that the initial sounds contain more information than the final sounds of words and also that a 'preceding' sound conveys more information on the average than a 'following' sound. This backward look at a supposedly on-going phenomenon is somewhat irregular. It is remindful of the changes that are introduced in the identification of the phonetic character of a preceding sound in synthesized speech by the modification of a subsequent sound (*10*).

Third, the phonetic structure of language is such that some sounds tend to be adjacent more frequently than others. Hence, the average information per sound in digrams is less than the average information per sound when the sound is treated as an isolated unit (although in a position to be either member of a digram). The decrements in information from (a) maximum or F_0, to (b) observed average bits per symbol $\frac{(i + j)}{2}$ or F_1, to (c) observed bits per 'digram symbol' or F_2 are in the various instances:[5]

3-sound, 1 syllable	5.35	4.85	4.21
4-sound, 1 syllable	5.35	4.28	3.35
4-sound, 2 syllable	5.35	4.50	3.89
5-sound, 2 syllable	5.35	4.32	3.89
6-sound, 2 syllable	5.35	4.37	3.75

On the basis of the above numerical values, the present phonetic code is being employed with relative efficiency in monosyllables of three sounds. Possibly the generalization is

[5]There is general interest in the amount of loss in efficiency of a language through redundancy. The present values relate to an assumption of maximum utilization of a system of 41 symbols. The second and third values of Row one could be achieved with 29 and 19 symbols; Row two: 20 and 10 symbols; Row three: 23 and 15 symbols; Row four: 20 and 15 symbols; and Row five: 21 and 14 symbols. This circumstance would, of course, presume equi-probable use of the symbols. The listener would have no clue within the word about what sound was coming next and the vocabulary would include all permutations of, for example, [dal] including [ald] [lad] [lda] [dla] [dal] [adl]. Obviously, as redundancy is reduced, the requirement for accuracy in symbol-by-symbol reception grows larger.

warranted that the efficiency with which the phonetic structure of English operates decreases within words of a particular syllabic length as the number of sounds increases.

The second set of results of this study applies a 'frequency-of-occurrence' tabulation of sounds to the 'mono-frequency' sample of words. For example, Table 1 summarizes an enumeration of the relative frequency of the 41 sounds in the population of words with initial, 'medial,' and final sounds treated separately. The table indicates the probability of each of the sounds among a population of initial sounds, a population of 'medial' sounds, and of final sounds in a non-repeating, dictionary-like group of one- and two-syllable words. In this instance there is no 'end problem' and all of the phonemes of the words are represented.

One method of tabulation might show the proportions with which each phoneme succeeds each other

TABLE 3. An enumeration of instances, based on an alphabet of 41 sounds, in which p_i (j) exceeds one in 10; an asterisk indicates that p_i (j) exceeds one in five, and a dagger that it exceeds one in four. The *i*-sounds precede the colon. The following sounds are pooled: [o, oʊ], [e, eɪ], [r, ɾ, ɚ, ɝ], [m, m̩], [n, n̩], and [l, l̩].

A. Three-sound, one-syllable words. N digrams, 1358.

i:	p,t,d,l.	aɪ:	n†,r,t,d,l.	z:	i,ɑ.
ɪ:	t,n.	p:	ɪ,æ,r.	ʃ:	i,e,ɑ,u.
e:	v,k,t,m.	b:	ʌ,æ.	h:	ʌ,ɪ,æ,ɛ,u.
ɛ:	t,r,n,l.	t:	r,ʌ,aɪ.	tʃ:	ɪ,æ,i,e,o.
æ:	k,t,ʃ.	d:	ɪ,ɛ,ɑ,ʌ,r.	dʒ:	ɪ†,ɑ†,ɛ,ʌ.
ɑ:	t,r,k,b,p.	k:	æ,o,ʌ.	m:	æ,ɑ,u.
ɔ:	t,s,l,k.	g:	æ,r,o.	n:	i,e,æ,ɑ,o.
o:	z,l,k.	f:	e,aɪ,r.	l:	i,æ.
ʌ:	g,m,ŋ.	v:	r*,æ,aɪ.	w:	ɪ,ɛ,i,e,ɔ.
u:	t,k,m.	θ:	r†.	hw:	ɪ*,aɪ*,i,ɑ.
ʊ:	l*,t*,ʃ*.	ð:	ɛ,i,æ,o,ʌ.	j:	ɑ*,ɔ†,ʌ†,r†.
aʊ:	t*,n†,tʃ,θ	s:	u,ɪ,i.	ŋ:	k.

B. Four-sound, one-syllable words. N digrams, 1884.

i:	d,k,s,m.	ɔɪ:	l*,s*,n*.	s:	t*,p†,k.
ɪ:	n,s,ŋ,f,l.	aʊ:	n*,t,d.	ʃ:	r*,æ,ɛ,ɑ.
e:	k,s,t,z,n*.	aɪ:	n,t,d.	h:	ɑ*,ɪ,ɛ.
ɛ:	n†,s†,l,z,d.	p:	r†,l.	tʃ:	æ*,ɑ*,ɪ,ɛ,ɔ,ʌ.
æ:	s,n,k,ŋ,m.	b:	l.	dʒ:	ɛ*,o*,ʌ*.
ɑ:	r*,k.	t:	r*,ɛ.	m:	p*,ɪ,aɪ.
ɔ:	r*,l†,n.	d:	r*,ʌ.	n:	tʃ*,t†,d†,s.
o:	r*,l*,s.	k:	r*,l,w.	l:	æ,t.
ʌ:	n,m,l.	g:	r*,l.	w:	ɪ*,ɛ.
ɚ:	e.	f:	r†,l†,t.	hw:	ɪ*,ɛ*,ɔ*.
u:	t,l,p,d,m,n.	v:	ɛ*,æ*,ɔ*,l.	j:	u*,i,ɛ,ɑ.
ʊ:	k*,f*.	θ:	l*,r*.	ŋ:	k*.

C. Four-sound, two-syllable words. N digrams, 1584.

i:	d,p,t.	au:	t*,r.	z:	l*,r*,n.
ɪ:	n,t.	aɪ:	t,d,r,n.	ʃ:	..†,n†,æ,o.
e:	b,s,p,l.	ju:	r*,t*.	ʒ:	r.
ɛ:	r,l,n,t.	p:	l†,r,ɪ.	h:	æ,ɛ,ɑ,ʌ.
æ:	t†,l.	b:	l,r,ɪ.	tʃ:	r*,æ*,ɪ†,aɪ.
ɑ:	l†,r,t.	t:	r*,ɪ,l,n.	dʒ:	r†,u.
ɔ:	r†,t,l,s.	d:	ɪ*,r,n,l.	m:	ɪ*,e,ʌ,r,æ.
o:	k.	k:	r†,l.	n:	ɪ*,r.
ə:	l*,b,m.	g:	r*,ɪ,n.	l:	e,r,o.
ʌ:	t,d,n.	f:	r*,ɑ,e,aɪ.	w:	d†,e†,ɪ.
r:	ɪ*.	v:	l,r*.	hw:	aɪ*.
u:	d†,l.	θ:	ɪ*,e,ə.	j:	r*.
ʊ:	r*,l*.	ð:	r*.	ŋ:	r*,ɪ*,k*.
ɔɪ:	s,z,n,l,ə,t.	s:	ʌ,ɪ,l.		

D. Five-sound, two-syllable words. N digrams, 3060.

i:	t,m,n.	aɪ:	n,t,d.	ʃ:	ə*,r,m.
ɪ:	t,n,s.	ju:	s,k,m,t†,z.	ʒ:	e*,ə*,r*.
e:	n†,t,s,d,m.	p:	r†,æ,ɑ,l.	h:	æ,ʌ,ɑ.
ɛ:	r†,n,s,k,l.	b:	l,ɪ†,r.	dʒ:	r*,ɪ,ɛ.
æ:	n,m,k.	t:	r*,ɪ†,l.	dʒ:	ɪ*,ə*,r,ɛ.
ɑ:	r*,l.	d:	r†,ɪ*.	m:	ɪ†,p.
ɔ:	s,l,r*.	k:	r†,ɪ,ə,l.	n:	ɪ,t,d.
o:	l,r,t,k,n.	g:	l*,r†,ɪ,ɑ.	l:	ɪ*.
ə:	n*,l,s.	f:	l,ɪ,r,ɔ.	w:	ɪ*,r,ɛ.
ʌ:	n*,m†,s,b.	v:	ɪ*,r†.	hw:	ɛ*,ɪ*.
u:	t†,l,n,r.	θ:	ɪ*,ɔ,ə.	j:	r*,ə*,u*.
ʊ:	ʃ*,l*,r*.	ð:	ɛ*,r*,ɪ,ə.	r:	ɪ†.
ɔɪ:	n*,ə†,s†,l†.	s:	t†,ɪ.	ŋ:	k*,g*.
au:	n*,t*.	z:	n,r,l,ɪ,ɛ.		

E. Six-sound, two-syllable words. N digrams, 2775.

i:	d†,s,t.	aɪ:	t,d,n,l,r.	ʒ:	ɪ*,æ*,ə*.
ɪ:	s,n,t,k.	ju:	b,t,d,v,m,w,s.	h:	ɛ†,æ,aɪ,ɑ,o.
e:	n,k,t,d.	p:	r†,l.	tʃ:	ɪ,ə,aɪ,r.
ɛ:	n*,s,l.	b:	l†,ɪ,r.	dʒ:	ɪ,ɛ,ə,ʌ.
æ:	n*,k,s,m.	t:	r*,ɪ.	m:	ɪ,ə,p.
ɑ:	r*,k,l.	d:	ɪ*,l.	n:	t*,d,s.
ɔ:	r*,l†.	k:	r†,ə.	l:	ɪ*,ə.
o:	r*,l†.	f:	ə,r,ɔ,ɪ.	w:	r†,ɪ,ə.
ʊ:	l*,t†,k†,r†.	v:	ɪ†,r,e,ɛ,ɑ,ə.	hw:	ɛ*,i†,ɑ†,aɪ†.
ə:	n*,s,n,l.	θ:	ɪ,ɔ,r,f,l,w.	j:	u*,ə*,r.
ʌ:	m†,s,n,l.	ð:	ɪ,ɛ,aɪ,d,s,r.	ŋ:	k*,g*,d,z,l.
u:	d*.	s:	t*,k.	r:	ɪ†.
ɔɪ:	l*,s*.	z:	ɪ*,ɔ,ə,n.		
au:	n*,s†,d,θ,z,r.	ʃ:	ə*,r.		

TABLE 4. An enumeration of instances, based on an alphabet of 41 sounds, in which p_j (i) exceeds one in 10; and asterisk indicates that p_j (i) exceeds one in five, and a dagger that it exceeds one in four. The *i*-sounds precede the colon.‡

A. Three-sound, one-syllable words. N digrams, 1358.

i:	f,p,θ,z,tʃ,d,v.	ɑ:	b*,p,k,g,dʒ,r,t.
e:	ð*,v*,dʒ†,k,z,m.	o:	z,v,l,p.
ɔ:	s,ŋ.	ʌ:	ŋ*,g*,b,m,v,ʃ,f.
r:	dʒ,u,e,tʃ,o,b,θ,ʌ,aɪ,i,ɪ,æ.	u:	ð*,θ,m,k,f,s.
ʊ:	θ.	ɔɪ:	n.
aʊ:	tʃ.	aɪ:	v,d,f.
b:	ʊ*,ɔɪ,ʌ.	p:	ʊ*,ju,aʊ,ɪ,æ.
d:	ɛ,aʊ,ɑ.	t:	ɔ,ɔɪ,ju,r,aɪ.
g:	aʊ.	k:	ɔɪ*,æ,o,ʌ.
m:	ju*.	f:	ɔɪ*,ju*,e,aɪ.
l:	i,ɔ,ɔɪ,æ,u,aɪ.	s:	w*,u,aʊ.
ɪ:	ŋ*,ð*,g†,p,d,tʃ,n,b,t,l.	h:	aʊ,ʌ.
ɛ:	dʒ,n.	n:	ju.
æ:	p,t,k,g,f,ʌ,s,tʃ*,dʒ,ŋ.	w:	ɛ.

B. Four-sound, one-syllable words. N digrams, 1884.

i:	ð*,tʃ,m.	t:	e,o,r.
ɪ:	ŋ*,f*,g,m,b,s,tʃ,n.	d:	j†.
e:	z*,n,v.	k:	j*,w*,o,l.
ɛ:	ʃ,s,n,dʒ,d.	g:	r.
æ:	g*,ʃ*,ŋ*,m,f,s.	f:	j†,z,ɔ.
ɑ:	r.	θ:	l.
ɔ:	θ,f.	s:	p*,t*,w*,k*,m.
o:	b,z.	h:	ɔɪ*,j†,ɑ.
ʌ:	g*,b*,m,ŋ,f,dʒ,tʃ.	m:	b,p.
r:	θ*,ʊ*,aɪ*,e*,u*,aʊ*,i*,dʒ*, ʌ*,ɔ*,ɔɪ*,ɛ,o,æ,ʃ,ɪ,v,d,tʃ,ɑ.	n:	tʃ*,dʒ*,d,θ,t,s.
		l:	ʊ*,æ*,i†,ɪ†,v†,ɛ,ʌ,d,ɑ,e, ɔ,aʊ,θ,aɪ,b,f,u.
aʊ:	n.	w:	ɪ.
aɪ:	v†,b,z.	j:	u.
p:	ɔɪ*,aʊ,aɪ.	ŋ:	k.
b:	r,ɑ,w.		

‡This table is not a true counterpart of Table 3. The differences between the two tables can be clarified through reference to the computational model. Table 1 was based on the probabilities of progressing from an *i*-sound to a *j*-sound. These probabilities would be taken from the *rows* of the computational model, each row totaling unity. Obviously, then, a maximum of 10 of the 41 cells in a row could have the probability 'one in 10.' A comparable procedure was followed in determining p_j (i), with the probabilities of each *column* totaling unity. If the *j*-sounds were enumerated ahead of the colon in Table 4, this table would be directly comparable to Table 3. The *i*-sounds, however, precede the colon in Table 4; hence, in the extreme instance, as many as 41 *j*-sounds (or column headings in the model) might follow the colon, each with a probability of one in 10. Actually, as many as 20 do appear together in one entry in Table 4B. Thus, in 4-sound, one-syllable words, when the probabilities are stated in terms of the *i*-sounds that may precede the *j*-sounds, [r] is a highly probable event in 20 instances.

C. Four-sound, two-syllable words. N digrams, 1584.

i: tʃ,g,ʃ,z,p,ʒ*.
ɪ: ð*,f*,dʒ*,v†,tʃ†,m†,g,ʃ,k,n,t,d,z,ŋ*.
e: dʒ*,b†,s,ʃ,p,z,v,k.
ɛ: ð*,f,dʒ,v.
æ: tʃ†,ŋ†,p,t,k,b,m,d.
ɑ: ð,p,b.
ɔ: ʃ,j*.
o: k.
ə: b,p.
ʌ: z,d,f,k,ŋ.
r: tʃ*,ɔɪ†,i,u,ɪ,o,aɪ,dʒ,g,m,l,θ*.
u: z.
aʊ: w*.
aɪ: ə,d.
p: ʌ,o.
b: ʊ*,ju†,ɔɪ†,ɛ,ʌ.
t: w,aɪ,æ,r,ə,u,n.
d: ɪ, n.
k: ɔ*,u,ju,ɑ.
f: ju†,ɑ,aɪ.
v: ə.
s: ʌ,ɛ,ɔ.
ʃ: ʊ*.
h: æ,ɑ,ɛ.
dʒ: ɔɪ†, dʒ.
m: ʌ,ɔ.
n: θ*.
l: ɔɪ*,e*,ʊ*,o†,aɪ,i,ɛ,u.
w: d,ɔ.

D. Five-sound, two-syllable words. N digrams, 3060.

i: tʃ.
ɪ: ŋ*,h*,ʃ*,dʒ*,v*,f*,z*,k*, s*,ð*,t†,d,m,θ,n,p,g,t,w.
ɛ: ʒ*,k.
æ: ð*,ŋ†,θ,v,g,m,k.
o: hw*.
ə: n†,b†,p,m,s.
ʌ: ð*,b,m.
ju: ʒ*.
p: ɑ,æ,o,ju,tʃ,ɔɪ†.
b: ɔɪ†,aʊ,h,ʌ,ɑ,u*.
t: ɔɪ†,r,e,i,w.
d: ʒ*,j*,ju,i,ɪ.
ɔ: f.
k: ʌ†,aʊ†,ɑ,ə,w*,ɔ.
g: ɑ.
f: ju*,ɔ,aʊ.
v: aʊ,aɪ.
s: ʌ†,w,tʃ,t,p,i.
h: ju.
m: b†,ɔɪ†,h,ɔ,o,æ,ɑ,ə,p†.
n: s,ʃ*,d*,h*,ɔɪ†,θ,aʊ,ju,t,dʒ,j*.
l: u†,aɪ†,θ,i,ɔ,ɪ,o,ə.
r: ʊ*,ð*,tʃ†,u†,b†,e†,i,æ,ɪ,ɛ,g, dʒ,d,t.
ŋ: g*.

E. Six-sound, two-syllable words. N digrams, 2775.

i: ð†.
ɪ: ŋ*,dʒ*,g*,hw*,z*,k*,s*,ʃ*, v*,n†,ð†,h†,θ,f,t,m,d.
e: θ,ʃ,v.
ɛ: p*,n,dʒ.
æ: b,dʒ.
ɑ: b.
ɔ: θ,r.
o: ð†,z.
ə: n*,m†,l,s.
ʌ: ŋ,m.
l: ɔɪ*,j*,æ,v,ɪ,o,ʌ,ə,f,aɪ.
w: ɔ,dʒ.
r: ʒ*,ð*,u*,i*,θ†,ɑ†,ɪ†,æ,ɛ,ʌ,aɪ, o,ə,aʊ,b,t,d,θ,ʃ*,w.
p: ʊ*,o*,e,ɑ,ɛ.
b: ʊ*,ju.
t: ju*,r,aɪ,e,w,ɛ.
d: h†,ju,ɪ.
k: hw*,w*,aʊ*,ə,j,æ,r.
g: ʒ*,u.
f: ɔ,u†.
θ: aʊ.
s: t†,p†,i†,tʃ,k,ʌ,aʊ,ɛ.
z: aʊ.
dʒ: h†.
m: hw*,p*,b†,j,aʊ,æ.
n: ɔɪ*,h*,j*,d*,t†,f,ju,tʃ,s,v,dʒ.
h: aʊ.

phoneme, these being so arranged that the rows, for example, would represent the *i*-sounds, and the columns, the *j*-sounds. Frequency or proportion of joint occurrence would be indicated and this cell value would state the probability that the sound *j* follows the sound *i* in one- and two-syllable words of various numbers of sounds. The same tables could be read vertically through the columns to find p_j (i), or the probability that an *i*-sound precedes an observed *j*-sound. Such tables, though available, tend to become excessive in size. Accordingly, the more frequent combinations have been extracted and appear in Tables 3 and 4. These two tables are not to be interpreted as listing the most frequent pairs of sounds in the words. This enumeration appears in Table 5. The entries in Table 3 relate to transitional probability: if *i*-sound occurs, then the chances are at least one in 10 that *j*-sound will occur. The *i*-sounds stand before the colon. Table 4 is similar to Table 3 except that the transitional

TABLE 5. An enumeration of instances in which digram probabilities, p (i,j), of one- and two-syllable words of all lengths pooled exceed .003. An asterisk indicates that the probability exceeds .010. The *i*-sounds of the digrams precede the colon.

A. One-syllable words. N digrams, 3973.

ɪ:	r,n,ŋ,p,t,s.	ŋ:	k.
e:	n*,k,t.	t:	r*.
ɛ:	n,l.	d:	r.
æ:	n,s,ŋ,k,m,p,t,ʃ.	k:	l,w,æ,o.
ɑ:	r*,t,k.	g:	l,r.
ɔ:	l,r.	f:	r,l,t.
o:	l,r.	θ:	r.
ʌ:	n,m,s,ŋ.	s:	t*,p*,k*,l,w.
aʊ:	n.	m:	p.
aɪ:	t,d,m.	n:	t,d,s,tʃ.
ŋ:	k.	l:	æ*,ɪ,i,ɛ,t,ʌ,d.
p:	r,l,æ,ɪ,ɛ.	w:	ɪ,ɛ,k.
b:	r,l,ʌ.	r:	e,æ,ɪ,i,ʌ,u,ɛ,o,t,ɔ,ɑ,d,m,aʊ,aɪ.

B. Two-syllable words. N digrams, 9024.

i:	s.	d:	ɪ*,r,l.
ɪ:	t*,k*,d,v,l,dʒ,p,f,ʃ,s*,n,m.	k:	r,ə,l,t,ɪ,s,ɑ.
ɛ:	n,s,r,t,k,d,l.	g:	r.
æ:	n,k,l.	f:	r,ə.
ɑ:	r,n.	v:	r.
ɔ:	r.	s:	t*,ɪ,k,p,l.
o:	r,l.	ʃ:	ə.
ə:	n,l,m,s.	m:	ɪ,p,ə.
ʌ:	n.	n:	d,ɪ,t*.
p:	r,l,ɑ,æ.	l:	ɪ*,ɛ,e,ə,r,æ.
b:	l,r,ɪ.	w:	ɪ.
t:	r*,l,n.	r:	ɪ*,t,æ,d,ɛ,ə,e,i,n,aɪ.

TABLE 6. Examples illustrating transitional probabilities with the same digrams in different categories of words. The *j*-sounds appear over each example and the *i*-sound at the left.

	1-syllable	*2-syllable*	*1-syllable*	*2-syllable*	*1-syllable*	*2-syllable*
	Example 1 [s]		*Example 2* [I]		*Example 3* [I]	
3-sound	[I] 0.7		[l] 3.7		[s] 2.2	
4-sound	4.9	1.9	9.3	4.5	39.4	0.6
5-sound		11.6		17.5		2.1
6-sound		17.8		15.8		6.1
	Example 4 [k]		*Example 5* [n]		*Example 6* [æ]	
3-sound	[s] –		[I] 6.6		[l] 5.2	
4-sound	13.5	0.6	6.6	8.9	11.5	1.9
5-sound		2.1		14.7		2.1
6-sound		6.1		17.8		4.8
	Example 7 [I]		*Example 8* [I]		*Example 9* [I]	
3-sound	[d] 3.7		[r] 5.2		[t] 2.2	
4-sound	–	12.1	7.1	18.1	2.7	8.0
5-sound		13.0		22.3		10.3
6-sound		12.9		21.7		8.3

probabilities are based on p_j (i). The *i*-sounds again are before the colon, however, as in Table 3.

Table 5, as described above, lists the most frequent digrams in terms of joint probability. The table enumerates the digrams that have at least a probability of .003 each.

A feature of digram probability that is revealed by treating words of various lengths separately is that different transitional probabilities occur with the same digrams in the different categories of words. The nine isolated examples shown in Table 6 are selected from the 41 x 41 matrix to illustrate this point.

The five values of *Example 1*, for instance, indicate that in three-sound words, the particular *j*-sound followed the particular *i*-sound with only one-seventh the probability that the same *j*-sound followed the same *i*-sound in four-sound, one-syllable words. This variability is even greater in two-syllable words. If the two-syllable word of this example contains six sounds, the probability is nine times as great as if the word has only four sounds, that if *i* occurs *j* will follow.

Exemplification and Summary

From a non-repeating population of root words a listener might hear a sample of five words, one of each of the five lengths that have been treated here. There is a biased probability with respect to the acoustic events in each word. The words might begin with the five most frequent initial sounds: [s], [k], [p], [b], and [r]. The most probable sets of acoustic events in the five words, together with their probabilities are: [sut], –, 0.152, 0.156;[6] [kren], –, 0.256, 0.103,

[6]By way of further explanation, in three-sound words, [s] having occurred, [u] has a probability of 0.152 of occurring as the next sound; and [u] having occurred, [t] is the most probable succeeding sound with a probability of 0.156.

0.280; [plebr], –, 0.197, 0.292, 0.157, 0.157 (on the basis of one-syllable probabilities); [bɪtɪ], –, 0.240, 0.138, 0.195 (on the basis of two-syllable probabilities); [rɪstrɪ], –, 0.219, 0.173, 0.335, 0.345, 0.219. Similar procedures originating with the five most frequent terminal sounds yield the following results (read the probabilities from right to left): [kæt], 0.113, 0.118, –;[7] [ɑrɛn], 0.118, 0.188, 0.135, –; [tætæt], 0.125, 0.146, 0.125, 0.146, –; [rɪmb], 0.169, 0.178, 0.227, –; [rɪstrɪ], 0.220, 0.273, 0.242, 0.185, 0.220, –. The examples indicate that in a sequence of English phonemes there are transitional probabilities of an order to indicate at least one chance in 10 that a particular sound will be next and that these chances may exceed one in three in some sequences.

In summary, the phonetic elements of English in root forms of words have dissimilar frequencies in the language, both in isolation and as digrams. These frequencies are not independent of the preceding and succeeding sounds. When the adjacent sounds are treated as pairs, the average redundancy is at least .20 and within the categories of words sampled reached .37. The sounds of words of three phonemes contain more average information per sound than do the sounds of longer words.

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[7] In this instance, [t] is the selected final sound. In three-sound words the most likely sound to precede [t] is [æ] and the probability is 0.118; in turn, the sound most likely to precede [æ] is [k], 0.113.

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An Experimental Investigation Of Dichotic Word Presentation

Paul H. Ptacek

AS EARLY AS 1846, the observation was made that when one watch was held to one ear and another watch was held to the other ear, both watches could not only be heard simultaneously, but each watch could be recognized and referred to the ear to which it was presented. Practical use has been made of this property of the ears by telephone operators and radio operators. It is common practice for them to use only one earphone for receiving incoming messages and keep their other ear free for listening to their immediate environment.

This peculiar ability of the ears to listen to two sounds simultaneously has not come under much scientific scrutiny until recently. Much of the research on the ear in the past has been devoted to studying one ear at a time. An exception to this is the case of auditory localization of sound for which both ears are necessary. Recently, investigators have become interested in binaural phenomena and, as a result, some aspects of this peculiar ability have been studied. Licklider (*13*) and Hirsh (*11*) have investigated how interaural phase relationships affect the intelligibility of speech. Investigators interested in explaining the hearing process, psychologists, and communication specialists have been concerned with the problem of how various masking sounds affect the threshold of a desired sound (*2, 5, 6, 9, 16, 19, 22*). Masking has been studied under various conditions, such as masking pure tones by pure tones, masking pure tones by noise, masking speech by noise, and masking speech by the noise created by having several people talking at once.

Up to the time of this experiment, no one, to the knowledge of this writer had used this ability of the ears to attend to two things at once to study human behavior in choice, decision-making, or conflict situations. The ear has some characteristics which recommend it for this type of study. Since the ear has practically no persistence or after image, it gives speech or other stimuli heard by the ears a somewhat fleeting quality and does not permit the listener to check back over what has been said as in the case of visual stimuli. Another feature of the ear mentioned by Henneman (*10*) which would recommend it for this type of experimentation is the 'attention-demandingness' of stimuli heard through the ears.

Recently, Cherry (*3*) reported on some experiments on the recognition of speech using one ear and two ears.

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Although the choice factor was not the explicit one under study, it was inherent in the experimental procedure. Continuous speech was used in these experiments and in some of the experiments different speech was introduced to each ear and the subject was instructed to repeat aloud one of the messages while listening to both of the messages.

Studying human behavior by stimulating the ears simultaneously with different stimuli, however, is not without problems. Aside from the mechanical and electronic problems of getting two sounds to the two ears simultaneously, there is the crucial problem, if words are to be used, of determining what characteristics of words influence a person's choice between words. This problem, investigating characteristics of words which influence their selection and repetition when presented dichotically at a supra threshold level, is the one which this investigation will attack.

More specifically, when a person is asked to select and repeat one word from a pair of words presented dichotically (one word in one ear and, at the same time, another word in the other ear), do such factors as familiarity with the words, length of the words, and the intelligibility of the vowel sound within the words influence the person's choice?

Definitions of Terms

Word familiarity. The standard used to determine word familiarity was the Thorndike ratings (*20*). This investigator is aware of the fact that this word count was based on written material, and that the frequency rating given to a particular word does not necessarily indicate that the individual subject will have the same familiarity with the word that is indicated by the count. A definite search was made to determine if a word count were available in which the spoken word was considered. A few such counts were found (*1*, *4*, 7, *8*, *21*), but they were of such limited scope that they could not be used in this study.

Vowel intelligibility. Vowel intelligibility was determined from a study conducted by Fletcher (*6*) in which he computed the percentage of times the various speech sounds were misinterpreted at normal intensities. Those vowel sounds which were misinterpreted a smaller percentage of times were considered more intelligible than those which were misinterpreted a greater percentage of times.

Dichotic. The definition given in Stevens and Davis (*18*) is the one used in this study: 'Dichotic stimulation refers to the simultaneous stimulation of both ears, but with a different stimulus in each ear.'

Supra threshold. Supra threshold generally refers to any sound which is above the threshold of the subject. In this investigation 40 microwatts of power was delivered to each earphone. No measurements were available for determining how loud the words were at the ear of the subject. The level of loudness of the words was set within the comfort range. The experimenter and two clinicians in the University of Minnesota Speech and Hearing Clinic agreed on their judgment that the words could be heard easily and that they were not too loud for comfort.

Simultaneous. Absolute simultaneity of the two words as they were presented to each ear was impossible. The two words arrive at the ears within plus or minus 16.6 milliseconds.

Two separate investigations were made, a preliminary one and a major one. Since both investigations attacked essentially the same problem with almost identical procedure and equipment, only the major investigation will receive detailed treatment. After the procedure of the major investigation has been explained, the preliminary investigation will be summarized briefly with comments relative to how the findings of this investigation influenced the procedure in the major investigation.

Procedure

Subjects for the major investigation. The subjects for the major investigation were recruited on a voluntary basis from Fundamentals of Speech classes at the University of Minnesota. The age range was from 18 to 29 with a mean age of 20.6. Two restrictions were made in selecting the subjects for the experiment. All subjects were required to have normal hearing as determined by a standard pure tone sweep check at plus 10 db conducted with an A.D.C. audiometer, type 50E, and no person could serve as a subject who had a foreign cultural background.

Equipment. The following pieces of equipment were employed in the experiments: Two Knight tape recorders, model 96-499; One pair of ANB-H-1A earphones; One dynamic microphone, Turner, model 330; Sound recording tape, Scotch 111A; One Webcor tape recorder, model 210-B; One VU meter; One white noise generator.

The two Knight tape recorders, the dynamic microphone, and the ANB-H-1A earphones comprised, in effect, two separate tape recording systems, and these were calibrated and checked for frequency response. The two systems were pronounced as being within 3 db of each other throughout the frequency range of 100-5000 cps by the Engineering Section of the University of Minnesota Audio-Visual Education Department.

The following modifications were made on the two Knight tape recorders before they were calibrated and checked for frequency response: In order to present two sounds simultaneously, the erase and record heads on one of the recorders were inverted to prevent erasure of the impulse put on the tape by the recorder which preceded it and to prevent recording over the previously recorded impulse. Also, it was necessary to remove the 'magic eye' tubes, type 6E5, from the control panels of the tape recorders and to mount them in a position which would permit the experimenter to observe the closure of the 'magic eyes' and the markings on the tape at the same time. The markings referred to above were the marks placed on the tape by the experimenter at regular intervals before recording; these marks were then used as signals to the experimenter for speaking the test words. Figure 1 shows the equipment arrangement and Figure 2 shows the synchronization method used.

Since there were three variables under study, the experimental plan was to hold two of the variables constant while varying the third. There

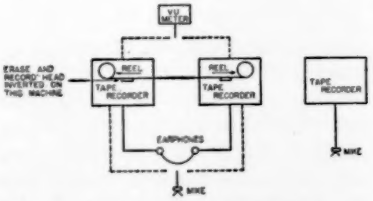

FIGURE 1. Block diagram of equipment.

was a total of 48 pairs of words, and in one third of the pairs of words presented, length was varied while word familiarity and vowel intelligibility were held constant; in another third of the pairs of words presented, familiarity was varied and word length and vowel intelligibility were held constant; and in the remaining third of the pairs of words presented, vowel intelligibility was varied while word length and familiarity were held constant.

The following measures of the variables were used: Length was measured by counting the syllables contained in the words. All words were monosyllables except those words which were varied in length and they were disyllables. Familiarity was measured by the Thorndike (*20*) count. All words were from the first thousand word list of Thorndike except in the case of the words which were varied in familiarity and they were from the eighth thousand word list of Thorndike. The measure of vowel intelligibility was derived from Fletcher's (*6*) data on the number of times the various speech sounds were misinterpreted. Fletcher computed the average per cent of times the various speech sounds were misinterpreted when presented at average intensities. From this data this investigator selected the vowel sounds and then selected pairs of words in which one of the words in the pair had a vowel sound which was two to four times more intelligible than the vowel sound in the other word.

In selecting the specific words to be used in the experiment, certain restrictions were placed on the words selected. Each pair of words had the same initial sound and, whenever possible, the compared pairs of words ended with the same sound. An exception to this was in the case of comparing one syllable words with two syllable words in which the first syllable of the two syllable word was identical with the one syllable word, and the second syllable of the disyllabic word was unstressed. In those pairs of words in which it was not possible to end the compared word with the same sound (words of varied length excepted) an attempt was made to select words ending in a voiced or unvoiced correlate of the final sound. If this were not possible, then the final sounds of the compared words were matched as far as belonging to the same general class of sounds, i.e., plosives or continuants.

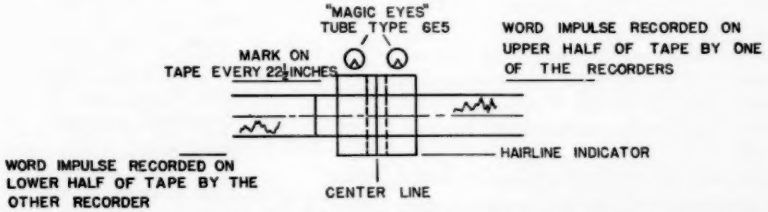

FIGURE 2. Detail diagram of synchronization method. When the mark on the tape passed the center line on the indicator, this was the visual signal used by the experimenter to speak a test word. This same mark was the signal for the experimenter in recording the test word on the upper half of the tape and the lower half of the tape. Each word was recorded at a different time, but they were synchronized by recording when the mark on the tape passed the center line of the indicator.

After all of the test words were selected, they were paired off in a manner which insured that an equal number of the longer words, more familiar words, and words having greater vowel intelligibility would be presented to each ear of the subject. Then all of the pairs of words were randomized for determining the order of presentation to the subjects. One pair of words was presented to the subject approximately every three seconds.

The pronunciation of all words used was checked against the pronunciations listed in Kenyon and Knott (*12*) before being recorded on the test tape. Then the actual recorded words were checked again for correct pronunciation by two senior speech clinicians in the Speech and Hearing Clinic. Likewise, the timing or synchronization of the words was checked by the method described earlier and verified by having another person check the experimenter's synchronization.

The relative intensity of the various pairs of words was checked with a standard VU meter. The average difference between the pairs of words was 1.5 db.

Test procedure with subjects. In recruiting the subjects for the experiment care was taken not to reveal the purpose of the experiment. It was simply referred to as a hearing experiment which was brief and impersonal and would in no way be damaging to them physically or mentally. All potential subjects were given a pure tone sweep check screening at 10 db and those persons not meeting this standard were not used as subjects. The only statement made by the experimenter was that the subject would receive all instructions through the earphones. Following are the instructions:

> In just a moment you will hear a sound in each ear. You are to adjust the volume control on the machine in front of you until you feel that the two sounds are equally loud in both ears.
>
> Now you will hear two different words presented to you at the same time, one word in one ear and another word in the other ear. You are to select and repeat aloud one word from each pair of words presented. The first five pairs of words you hear will be practice words so you may judge the time interval between the presentation of the pairs of words. In this way you will be able to determine how much time you have to respond to the pairs of words presented. It is important that you begin selecting and repeating one word from each pair with the practice words, because there will be no signal or pause between the practice words and the test words.
>
> Remember, you are to select and repeat *aloud* one word from each pair of words presented.

After the subjects had adjusted the volume control on the machine directly in front of them, this setting was recorded by the experimenter. Then as the subject began selecting and repeating the test words, the experimenter recorded them on a tally sheet. In the event that there was a question as to which word was repeated by the subject, a check was made against the tape recording which was made of the subject's responses. When the subject failed to respond to a pair of words it was called a 'miss.' When the subject's response to a pair of words was a word other than one of the words presented it was called a 'variation.'

Summary of Preliminary Investigation

The procedure employed in the preliminary investigation was essentially the same as that described for

the major investigation. Following are the differences in procedure: The *N* was 30 instead of 40. The number of pairs of words presented to the subjects was 30 instead of 48. In contrasting familiarity the contrast was from the first thousand words (Thorndike) to the fifth thousand words (Thorndike) instead of from the first to the eighth thousand words. Instead of equating the words on the basis of vowel intelligibility, they were equated on the basis of phonetic power of the sounds making up the words. The measure of length was the same in both studies.

The findings of the preliminary investigation were as follows: Two syllable words were selected a significantly greater number of times than one syllable words (.025 level), the more familiar words were selected more often than the less familiar words, but not significantly so, and the words containing greater phonetic power were not selected a significantly greater number of times than those containing less phonetic power. Since the phonetic power category failed to show even a trend, the words were analyzed from the standpoint of the intelligibility of the vowel sounds within the words. This analysis demonstrated a trend in the direction of selection of words having a vowel sound with greater intelligibility. This was the basis for using vowel intelligibility as one of the variables in the major investigation. Since a definite trend was evidenced in favor of selecting the more familiar words, the contrast in familiarity was raised from the fifth thousand word list to the eighth thousand word list in the major investigation.

Results of Major Investigation

As was described in the instructions, the subjects were asked to adjust the volume control on the machine in front of them until the two sounds in their separate ears appeared equally loud. The type of sound used was white noise. In order to determine whether the setting of the volume control had any appreciable influence on the selection of words going into one ear or the other, scatter diagrams were plotted comparing the volume settings with the responses of the right ear and the left ear. Careful inspection of the diagrams failed to show any clear relationship between the volume control setting and the number of words selected and repeated from either ear. The mean volume control setting was quite close to the original setting at which the words were recorded, there being approximately .5 db difference between the two settings.

In the preliminary investigation, a slight but not significant preference for words introduced to the left ear was shown. In the major investigation, a slight, but not significant preference was shown for words introduced into the right ear. This reversal of the absolute direction of the empirical mean responses of the ears between the two experiments supports the contention that no systematic ear preference was operative.

Comparison of words in which length was varied. The two syllable words were chosen a significantly greater number of times than the one syllable words. According to the Sign Test tables appearing in Dixon and Massey (*5*), this difference in the number of times the longer word was chosen in preference to the shorter word was significant at the .005 level. In 15 of the 16 pairs of words in which length was varied and familiarity and vowel intelligibility were held constant, the longer word was chosen more times than the shorter word.

TABLE 1. Results of length varied category in major investigation. (N=40)

*Stimulus Words**		*Words Selected*						
Right Ear	*Left Ear*	*One Syllable*	*Two Syllable*	*Variations*	*Misses*	*Chi Square*	*Probability*	*Sign‡*
Sit	*City*	24	15	0	1	2.076	.157	–
Ready	Red	16	23	0	1	1.256	.277	+
Do	*Duty*	6	34	0	0	19.600	†	+
Something	Some	4	36	0	0	25.600	†	+
Certain	Sir	7	31	2	0	15.158	†	+
Set	*Settle*	15	23	2	0	1.684	.205	+
Stay	*Station*	12	17	1	0	5.770	.017	+
Knee	*Neither*	0	36	4	0	36.000	†	+
Lady	Laid	2	38	0	0	32.400	†	+
Off	*Office*	6	34	0	0	19.600	†	+
Lion	Lie	10	27	3	0	7.838	.006	+
Window	Wind	4	36	0	0	25.600	†	+
Let	*Letter*	2	37	1	0	31.410	†	+
Former	Form	11	27	2	0	6.736	.010	+
Market	Mark	0	40	0	0	40.000	†	+
Man	*Manner*	7	27	6	0	11.764	.001	+

*Italicized word is the two syllable word.

†P beyond the tables.

‡Plus indicates majority of choices in direction of hypothesis; minus indicates majority of choices in direction counter to hypothesis.

Table 1 contains the pairs of words, their frequency, chi square values, probabilities, and the sign indicating whether or not the selection was for or against the hypothesis that the longer words tend to be selected in preference to the shorter words. Inspection of this table shows that in 13 of the 15 pairs of words in which the longer word was selected in preference to the shorter word, the chi square values were significant at or beyond the .01 level. In the case of the one pair of words in which the shorter word was selected more frequently than the longer word, the computed chi square was not significant.

Previous investigators (*2*, *19*) have found that the word length is an important factor as far as intelligibility is concerned. Although the present study is not an intelligibility study, it is reasonable to hypothesize that intelligibility factors may be related to the selection and repetition of words present dichotically at a supra threshold level. In the case of word length, which other investigators have found to be an important factor in intelligibility, the present results are consistent with this hypothesis.

Comparison of words in which familiarity was varied. The more familiar words, or the words drawn from the first thousand word list of Thorndike (*20*) as compared with those drawn from the eighth thousand word list, were chosen a significantly greater number of times than the less familiar words. Using the Sign Test tables appearing in Dixon and Massey

(5), this difference was found to be significant at the .025 level. In 12 of the 16 pairs of words in which familiarity was varied, and length and vowel intelligibility were held constant, the more familiar word was chosen more times than the less familiar word. Table 2 contains the pairs of words, their frequency, chi square values, probabilities, and the sign indicating whether or not the selection was for or against the hypothesis that more familiar words tend to be selected in preference to the less familiar ones. Inspection of this table shows that in nine of the twelve pairs of words in which the more familiar word was selected that the chi square values were significant at or beyond the .02 level. In the three instances in which the less familiar word was selected in preference to the more familiar word, the chi square values were highly significant in two instances and not significant in the other instance. One pair of words received an equal number of choices thus yielding a zero chi square value. Previous investigators (2, 17) have found that familiarity with words is an important factor as far as intelligibility is concerned. Again, although the present study is not an intelligibility study, it is reasonable to hypothesize that intelligibility factors may be related to the selection and repetition of words presented dichotically at a supra threshold level. In the case of word familiarity, which other investigators have found to be an important factor in intelligibility, the present results are consistent with this hypothesis.

TABLE 2. Results of familiarity varied category in major investigation. (N=40)

*Stimulus Words**		*Words Selected*						
Right Ear	*Left Ear*	*First Thousand*	*Eighth Thousand*	*Variations*	*Misses*	*Chi Square*	*Probability*	*Sign‡*
Ode	*Oak*	8	26	4	2	9.530	.0025	–
Rind	*Right*	14	14	9	3	0.000		±
Gauze	*Gone*	14	24	0	2	2.632	.102	–
Shore	Shoal	22	1	16	1	19.174	†	+
Dust	Dump	31	8	1	0	13.394	†	+
Code	*Coat*	21	19	0	0	0.100		+
Graft	*Grant*	8	25	6	1	8.758	.004	–
Gift	Gig	33	7	0	0	16.900	†	+
Yelp	*Yet*	27	8	5	0	10.314	.0017	+
Branch	Brag	18	7	15	0	4.840	.028	+
Moat	*Most*	30	10	0	0	10.000	.002	+
Post	Poke	33	7	0	0	16.900	†	+
Save	Sane	17	12	11	0	.862		+
Not	Notch	20	18	2	0	1.052	.309	+
Seethe	*Seize*	29	1	10	0	36.100	†	+
Lost	Loft	40	0	0	0	40.000	†	+

*Italicized word is the more familiar word.

†P beyond the tables.

‡Plus indicates majority of choices in direction of hypothesis; minus indicates majority of choices in direction counter to hypothesis.

TABLE 3. Results of vowel intelligibility varied category in major investigation. (N=40)

*Stimulus Words**								
Right Ear	*Left Ear*	*More Intelligible*	*Less Intelligible*	*Variations*	*Misses*	*Chi Square*	*Probability*	*Sign‡*
Look	*Lot*	4	21	12	3	11.560	.001	−
Stop	Step	23	13	4	0	2.778	.098	+
Hope	Had	16	21	3	0	.676		−
Class	*Close*	19	19	2	0	0.000		±
But	Book	2	19	19	0	13.762	†	−
Noon	*None*	8	27	5	0	10.314	.001	−
Note	Need	21	16	3	0	.674		+
Fell	*Feel*	30	4	6	0	19.882	†	+
Met	*Must*	31	7	2	0	15.158	†	+
Doubt	Did	12	27	1	0	5.770	.017	−
Call	Cool	8	24	8	0	8.000	.005	−
Bread	*Break*	9	24	6	1	6.818	.009	−
Mile	Mill	30	4	6	0	19.882	†	+
Walk	*Work*	17	18	4	1	.286		−
Back	*Big*	13	22	5	0	3.314	.072	−
Word	Wait	29	11	0	0	8.100	.0045	+

*Italicized word is word with greater vowel intelligibility.

†P beyond the tables.

‡Plus indicates majority of choices in direction of hypothesis; minus indicates majority of choices in direction counter to hypothesis.

Comparisons of words in which vowel intelligibility was varied. The words containing the vowel sounds with greater intelligibility were not, on the whole, chosen a significantly greater number of times than the words containing a vowel sound of lesser intelligibility. Likewise, the words with lesser vowel intelligibility were not, on the whole, chosen a significantly greater number of times than the words containing a vowel sound of greater intelligibility. In six pairs, the words with greater vowel intelligibility were chosen, and in nine pairs the word containing the vowel with lesser intelligibility was selected. In one pair, both words received an equal number of choices. Table 3 contains the pairs of words, their frequency, chi square values, probabilities, and the sign indicating whether the selection was for or against the hypothesis that words having vowel sounds of greater intelligibility tend to be selected in preference to words having vowel sounds of lesser intelligibility.

This investigator was unable to find a factor or factors to explain the significant choices in this category. Perhaps, in the choice situation used in this experiment, prediction of the word selected from phonetic content alone becomes virtually imposible, as was found in the word intelligibility study by Black (2). Black makes the following statement regarding predicting the intelligibility of a word from its phonetic content alone:

> . . . Thus two contrary influences, word familiarity and word complexity, appear to operate in the auditory recognition of a word somewhat independently of the phonetic content. The prediction of

> word intelligibility from phonetic content alone, as may be feasible in the instance of nonsense syllables, becomes virtually impossible . . .

Combining the results of the studies. Since both the preliminary investigation and the major investigation were concerned with similar variables, used similar equipment, and followed essentially the same procedure, one experiment may be considered a replication of the other one. When considered in this light, the probabilities for each experiment in each category, such as length varied, and familiarity varied, can be multiplied, yielding a probability for the combined investigations.

In combining the length varied categories for each experiment the probability becomes $.025 \times .005 = .0001$ and in combining the familiarity varied category, the joint probability becomes $.025 \times .171 = .004$. Since the vowel intelligibility categories failed to show consistency in the direction of their trends, combining the probabilities was not feasible.

Summary and Conclusions

The purpose of this study was to investigate the influence of word length, word familiarity, and vowel intelligibility on the selection and repetition of words presented dichotically at a supra threshold level. Two separate investigations were conducted, a preliminary one with 30 subjects, and a major one with 40 subjects. The age range of the subjects was from 14 to 49. Essentially the same equipment and procedure was used in both investigations.

Since three variables were being studied, the experimental plan was to hold two of the variables constant while varying the third. In other words, in one third of the pairs of words presented, vowel intelligibility and word familiarity were held constant while word length was varied; in another third of the pairs of words vowel intelligibility and word length were held constant while word familiarity was varied, and in the remaining third of the pairs of words, length and familiarity were held constant while vowel intelligibility was varied. The measures of the variables used were as follows: Familiarity was determined from the Thorndike word count, length was measured by counting the syllables (all words were monosyllables except the longer words which were disyllables), and the measure of vowel intelligibility was derived from Fletcher's data on the number of times the various speech sounds are misinterpreted. After the test words were selected, they were paired off in a manner which insured that an equal number of the longer words, more familiar words, and words having greater vowel intelligibility would be presented to each ear of the subject. The pairs of the words were randomized for determining the order of presentation to the subjects.

A pair of words, one word in one ear and another word in the other ear, was presented simultaneously ($\pm$ 16.6 milliseconds) to the subject approximately every three seconds and he was asked to select and repeat aloud one word from each pair of words presented.

Results. Longer words and more familiar words were selected a significantly greater number of times than shorter words and less familiar words.

The sign test and chi square tests reached convincing levels of significance in the cases of the longer words and the more familiar words. The

vowel intelligibility category failed to show significance.

Since there were two separate studies with essentially the same equipment and procedure, one study was considered a replication of the other, and the probability of getting the results obtained in the separate studies was calculated. In the case of varied length this probability was .0001, and in the case of varied familiarity the probability was .004. Because the vowel intelligibility category failed to show consistency in the direction of the choices, computing the probability was not feasible.

Conclusions. Within the limitations of the experiment, the following conclusions are offered: Length and familiarity are significant factors in the selection and repetition of words presented dichotically at the supra threshold level other factors being equal. Vowel intelligibility does not appear to be a significant factor. Those factors which through previous investigations have been found to be important in determining word intelligibility also seem to be important in the selection of words presented dichtically.

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Pitch Level And Nasality

Dorothy Sherman

Fred Goodwin

A RECOMMENDED technique for reduction of hypernasality is to lower the pitch level (*2*, *3*, *4*, 7, *10*). Previous research, however, provides the speech clinician with little information about the effectiveness of the procedure. Most prior studies have not dealt with perceptual changes in nasality. Several investigators have attempted to compare nasal and non-nasal speakers with regard to characteristics of certain physical structures which alter the speech resonating chambers. From such studies as those reviewed by McDonald and Baker (*6*), the opinion is widely held that the physiological variations in function for speech most likely to be related to nasality are inadequate velopharyngeal closure, humping the dorsum of the tongue, and insufficient oral activity. From these studies no obvious reason for employing the clinical technique under consideration is evident. Changes in pitch level, however, might affect pharyngeal muscular tension and also the size and shape of the resonators in such a manner as to modify degree of perceived nasality.

The purpose of this study was to test the effect of pitch level changes on degree of perceived nasality. The specific questions asked were the following: (1) Does the degree of perceived nasality change when nasal speakers read at a lower pitch level than the habitual pitch level? (2) Does the degree of perceived nasality change when nasal speakers read at a higher pitch level than the habitual pitch level? (3) Are there differences between male and female nasal speakers with respect to degree of perceived nasality as a function of pitch level?

Tape recordings were made of readings by 20 nasal speakers, 10 males and 10 females. Three separate readings were recorded for each voice: one at the habitual pitch level, one higher than the habitual level, and one lower than the habitual level. A group of observers rated the samples for degree of severity of nasality. The resultant scale values of severity were analyzed to determine whether there were differences among pitch levels and between sexes.

Recordings were made at 15 inches per second on a Concertone Magnetic Recorder, Model 504, with an Electro-Voice microphone, Model 731. Playback equipment included the Concertone, a Knight 80-watt amplifier, Model 93-380, and a Jensen BF 409 Multicellular Horn speaker system. The recordings were made and the samples were rated in a sound-treated room.

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Procedure

Selection of Subjects. Thirty speakers with nasal voices with no known organic basis for nasality were trained individually by the experimenter to read at higher and lower pitch levels than the habitual level. Judgments concerning the ability of subjects to read at the higher and lower pitch levels were made by the experimenter who had had professional experience in both speech pathology and music. Two subjects were judged to be unable to read at the various levels as directed. A reading of a short selection[1] was recorded for each of the remaining 28 subjects at each of the three pitch levels. In the opinion of the experimenter instructions to read at the various pitch levels were followed during the recording. Recordings of readings at habitual pitch level were presented to two judges, members of the Iowa Speech Clinic staff, who had had considerable experience with diagnosing voice disorders. Final selection of subjects, 10 males and 10 females, was based upon agreement among the judges and the experimenter on two items: (1) presence of definite nasal quality; and (2) absence of other quality deviations.

Preparation of Recorded Speech Samples. The 60 speech samples, three for each subject, were assembled in random order with the restriction that no two samples for any one voice were adjacent. A two-second interval separated adjacent samples. Each sample was approximately 20 seconds long. Sample announcements by number were recorded immediately before each sample. The tapes also were prepared for judgments with each sample played backwards but with the samples following each other in the same predetermined random order.

Rating the Samples. Thirty judges, seniors and graduate students in speech pathology who had training in diagnosis of voice disorders, rated the speech samples twice: first with the samples presented as they were recorded and second, at a later session, with the samples played backwards.

Judgments were obtained on the samples played backwards because experimental evidence reported by Sherman (*8*) indicates that when samples of connected speech are played forwards judgments of nasal vowel quality are affected by irrelevant factors. Judgments were also obtained on the samples played forwards to provide more information for evaluating the usefulness of the clinical technique in question.

To establish for the judges a range of nasal severity, six tape-recorded samples carefully scaled in a previous experiment (*8*) and representing various levels of nasal severity were presented first. The six samples were presented forwards or backwards according to the required experimental task for each listening session. Judges learned the experimental task by a preliminary rating of samples 31 through 50.

The 60 samples were rated by the method of equal-appearing intervals on a seven-point scale extending from *one*, representing least severe nasality, to *seven*, representing most severe nasality.

Results and Discussion

Scale Values. Median scale values and *Q*-values, which measure dispersion of judgments, were computed for the 60 speech samples in the man-

[1]The selection read was from the first paragraph of 'The Rainbow Passage' (*1*).

TABLE 1. Summary of analysis of variance, testing differences among mean scale values obtained from forward-play judgments of degree of nasality present in the voices of 10 male and 10 female subjects reading at three pitch levels.

Source of Variation	*df*	*ss*	*ms*	*F*	$F_{.05}$
Between Subjects (S)	19	99.18			
Groups (G)	1	23.85	23.85		
error (b)	18	75.33	4.19		
Within Subjects (S)	40	13.02			
Pitches (P)	2	1.12	.56		
GP	2	2.05	1.03	3.81*	3.26
error (w)	36	9.75	.27		
Total	59	224.30			

*$F = ms_{GP}$/error (w)

ner described by Thurstone and Chave (*9*).

The obtained mean *Q*-values were .90 for the samples presented forwards and .98 for the samples presented backwards. Previous research has provided evidence that scale values of severity of nasality derived from judgments on a seven-point scale were satisfactorily reliable both for samples presented forwards and for samples presented backwards, with obtained mean *Q*-values of .81 and .97, respectively (*8*). To the extent that reliability may be judged by the size of the *Q*-values, the scale values obtained in the present experiment may be considered fairly satisfactory.

Analysis of the Data. An analysis of variance, designated by Lindquist (*5*) as Type I, allowed for comparison of degrees of perceived nasality (1) within subjects for readings at the three pitch levels and (2) between male and female groups.

Forward-play Presentation. From the analysis of scale values obtained from the forward-play presentation, summarized in Table 1, the mean amount of perceived nasality from one pitch level to another did not follow the same trend for male and female groups, as indicated by the significant[2] interaction between groups and pitch levels. Results of separate *F*-tests for males and for females[3] indicate significant differences among means at the three pitch levels for males but not for females. Males were significantly less nasal at the lower pitch levels than at either their habitual or their higher pitch levels. The difference required at the five per cent level was .44[4]. The means for lower, habitual, and higher pitch levels for males were 3.68, 4.33, and 4.27, respectively.

Backward-play Presentation. Results of the analysis of the scale values obtained when the samples were presented backwards, summarized in

[2]The level of significance selected for all tests in this study was 5%.

[3]$F = ms_P/ms_{error(w)} = 9.56$ for males and 2.19 for females. $F_{.05}(df = 2 \text{ and } 36) = 3.26$.

[4]The difference required for significance was computed by the following formula: Required difference $(df = 36) = t_{.05}\,(2ms_{error(w)}/N)^{1/2}$.

TABLE 2. Summary of analysis of variance, testing differences among mean scale values obtained from backward-play judgments of degree of nasality present in the voices of 10 male and 10 female subjects reading at three pitch levels.

Source of Variation	*df*	*ss*	*ms*	*F*	$F_{.05}$
Between Subjects (S)	19	64.18			
Groups (G)	1	4.64	4.64	1.40*	4.41
error (b)	18	59.54	3.31		
Within Subjects (S)	40	15.74			
Pitches (P)	2	.51	.26	.67†	3.26
GP	2	1.18	.59	1.46‡	3.26
error (w)	36	14.05	.39		
Total	59	159.84			

*$F = ms_G$/error (b)

†$F = ms_P$/error (w)

‡$F = ms_{GP}$/error (w)

Table 2, indicate no significant differences, either between sex groups or among pitch levels.

Analysis of *Q*-values. The four sets of *Q*-values associated with the median scale values for males and for females for each of the two methods of presenting the samples were analyzed with a subjects-by-pitch levels design. Results of these analyses are given in Table 3. Only for the males with the samples presented forwards were there significant differences among mean *Q*-values for the three pitch levels. The difference required at the five per cent level was .11[5]. The means for lower, habitual, and higher pitch levels were .99, .76, and .82, respectively. The mean *Q*-value for the lower pitch was significantly larger than for either habitual or higher pitch levels. This significantly larger dispersion of judgments corresponds to the previously discussed significant decrease in perceived nasality for males when the samples were presented forwards.

Discussion. Evaluation of the data provides little evidence to support the hypothesis that there is a relationship between pitch level and perceived nasality. In the first place, the decrease in perceived nasality for the males when the samples were presented forwards, while statistically significant, is probably of little clinical significance. The mean reduction of nasality as pitch was altered from habitual to lower level was only .65 of a scale value. In the second place, this significant reduction of severity was accompanied by a significant increase in dispersion of judgments, which would seem to indicate that some factor other than nasal quality might have influenced some observers' ratings. Possibly some observers had a strong preference for low pitch levels in males which resulted both in lower scale values and wider dispersion of

[5]The difference required for significance was computed by the following formula: Required difference ($df = 18$) = $t_{.05}\,(ms_{PS/8})^{1/2}$.

TABLE 3. Summary of analyses of variance, testing differences among mean Q-values corresponding to median scale values of nasality at three pitch levels.

Source of Variation	*df*	*ss*	*ms*	*F*	$F_{.05}$
Men, forward-play					
Pitch (P)	2	.31	.155	4.84*	3.55
Subjects (S)	9	.63	.070		
P × S	18	.58	.032		
Total	29	1.52			
Women, forward-play					
Pitch (P)	2	.22	.110	1.34*	3.55
Subjects (S)	9	.13	.144		
P × S	18	1.47	.082		
Total	29	1.82			
Men, backward-play					
Pitch (P)	2	.06	.030	1.30*	3.55
Subjects (S)	9	.43	.048		
P × S	18	.41	.023		
Total	29	.90			
Women, backward-play					
Pitch (P)	2	.02	.010	0.15*	3.55
Subjects (S)	9	.39	.043		
P × S	18	1.20	.066		
Total	29	1.61			

*$F = \mathrm{ms}_P / \mathrm{ms}_{PS}$

judgments. That such a factor would exert a stronger influence when the samples were presented forwards seems reasonable. In view of the lack of significant change when the samples were presented backwards, the conclusion that some characteristic of speech other than voice quality had an irrelevant influence upon the severity ratings for males at the lower pitch level when the samples were presented forwards seems warranted.

The technique of lowering pitch level to reduce functional hypernasality apparently should not be applied as a routine precedure. For certain speakers, however, the technique might be effective. At the lower pitch level, one subject, a male, exhibited a fairly large reduction of nasality both with the forward and the backward presentations. With the samples played forwards his scale values for habitual and lower pitch levels were 4.75 and 3.29, respectively, and, with the samples played backwards, 4.30 and 2.57, respectively. For no other subject was the reduction as large as one scale unit with both methods of presenting the samples.

Summary and Conclusions

The purpose of this study was to evaluate the effect of pitch level change on perceived nasality in the

voices of male and female nasal speakers.

Ten males and 10 females whose voices were judged to be nasal and free from other voice quality deviations were trained to read at pitch levels higher and lower than habitual pitch. Tape recordings were made of readings at the three pitch levels. The speech samples were scaled on a seven-point equal-appearing intervals scale of nasal severity by a group of 30 judges. The samples were presented in two ways: by playing the tapes forwards as they were recorded and by playing the tapes backwards. The obtained median scale values were analyzed for differences among pitch levels and between groups.

On the basis of the experimental results the following conclusions seem warranted:

1. Lowering pitch level is not to be routinely applied as a technique for reducing functional hypernasality in the voices of males or females.

2. Raising pitch level has no important effect upon the degree of perceived nasality in the voices of male or female nasal speakers.

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Contributions Of The Visual Components Of Oral Symbols To Speech Comprehension

John J. O'Neill

SPEECH IS usually regarded as an oral-auditory process. It has visual characteristics, however, that the deaf and hard of hearing may employ in the understanding of speech through lip-reading, and that may contribute to normal communication. Since most verbal communication is direct, face-to-face, oral sending-receiving, the perception of speech might be regarded as a bi-sensory (auditory-visual) phenomenon. Numbers and Hudgins (*14*) suggest that normal hearing individuals make use of the eye in the reception of speech. Johnson (*11*) states that understanding is the easier because we see while we hear. Little experimental effort, however, has been directed toward an analysis of the contribution of lip-reading to the oral communication of normal hearing persons. The purpose of this study was to assess the relative contribution that lipreading makes in person-to-person communication. It involves a measurement of the effect of vision and audition singly and simultaneously in the relative discrimination of simple and complex information.

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Procedure

Thirty-two experimental subjects listened to each of three speakers under eight experimental conditions. These consisted of four speech-to-noise ratios; in each of these four conditions the listeners viewed and then did not view the speakers. The noise levels, re. .0002 dynes per cm.^{2}, were 86 decibels (–20 db speech-to-noise ratio), 76 decibels (–10 db speech-to-noise ratio), 66 decibels (0 db speech-to-noise ratio) and 56 decibels (+10 db speech-to-noise ratio). The noise was uniform spectrum, random noise with frequencies above 10,000 cycles being filtered out. The mean, sustained voice level of the speakers was 66 decibels as measured by a General Radio (Model 759-B) sound level meter (C scale) two feet in front of the speakers. The speech-to-noise ratios were derived by setting the noise levels relative to this speech signal. The speakers were guided in maintaining their speech level by a visual monitoring system. This consisted of a magnetic throat microphone, the output of which was lead to a voltmeter through a hearing aid amplifier.

Undergraduate students served as listeners. None had any training in lip-reading, and all had normal hearing. Subjects were grouped into eight-

member listening panels. Each panel was seated in a semi-circle eight feet removed from the talkers. A panel viewed three speakers in succession. Responses were recorded on either write-down or standard multiple-choice forms for intelligibility testing (*8*). These responses were made as each speaker read in the four speaking conditions, i.e., vowels, consonants, words and phrases. The materials read were seven vowels [u ɪ e ɛ i ʊ o]. All were spoken as the second sound in monosyllables. Each vowel was in combination with the consonant [p] throughout. Seven consonsants [p k t f s θ ʃ] were employed. All consonants were spoken in combination with the vowel [i]. The verbal condition using words employed words that had been selected from Forms A and B of a multiple-choice (VCL) intelligibility test (*8*). There were 24 word lists of 21 items each. Items were placed in groupings on the basis of similar mean relative intelligibility values. The values which ranged from 47.7% to 48.9% were obtained from the mean per cent values computed by Hanley (*9*). The third set of test materials was 21 lists of five-syllable phrases which contained from three to five words. The lists were equated with respect to sound pressure level and duration (*2*). The test scores of individual subjects were variously pooled to yield the number of correct responses for each listener, each type of material, each condition and each speaker. These composite scores were then submitted to statistical analysis. The statistical treatment was analysis of variance. The *F*-ratio was used to test the significance of differences between the variables in the principal comparisons: (1) between the recognition of speech signals under visual and non- isual circumstances, and (2) among scores obtained under each of the four speech-to-noise ratios.

Results and Discussion

The data that pertained to each of the four kinds of stimulus materials were analyzed separately. The results will be reported with respect to the identification of the four classes of oral materials under the following types of perception: (a) lipreading (visual), (b) intelligibility (auditory),

TABLE 1. Summary of analyses of variance: Measurements of listeners' identifications of vowels, consonants, words and phrases under eight visual and auditory conditions. (Three speakers pooled.)

Sources of Variation	*df*	*Variance†*			
		Vowels	*Consonants*	*Words*	*Phrases*
Vision (V)	1	773.54**	2645.81**	953.26**	304.06**
Conditions (C)	3	1187.08**	661.01**	975.18**	2950.00**
Listeners (L)	31	49.42	41.02	11.63	19.97
C × V	3	81.64**	226.80**	140.02**	36.84**
C × L	93	6.00	9.93	6.19	7.35
V × L	31	8.58	12.52	7.67	3.25
C × V × L	93	5.32	5.51	3.30	3.81

**Significant (*F*) at the 1% level of confidence.

†Variance V/Variance V × L; Variance C/Variance C × L.

TABLE 2. Mean scores for four types of material under four experimental conditions. (Three speakers pooled, possible score of 21.)

	Vowels	*Consonants*	*Phrases*	*Words*
Visual				
–20 db	9.14	15.22	5.44	13.40
–10 db	13.97	15.21	11.84	14.93
0 db	15.69	18.06	17.50	18.25
+10 db	16.60	17.89	18.41	18.59
Non-Visual				
–20 db	3.16	3.28	1.84	5.44
–10 db	9.69	9.59	8.47	11.34
0 db	13.65	13.38	13.31	15.50
+10 db	15.50	14.34	18.03	17.53

(c) lipreading and intelligibility (auditory-visual). The four types of spoken materials were never directly compared. Thus there were four parallel sets of analyses, each involving four variables, i.e., *vision-no vision*, *conditions*, *listeners*, and *materials*. The basic measures were the pooled scores from three speakers. Table 2 lists the mean values of these scores.

Visual Reception. With each of the four types of materials the variance attributable to *vision* was clearly significant (see Table 1). In assessing the relative contributions that vision made to recognition it was assumed that a speech-to-noise ratio of –20 db would effectively mask speech signals inasmuch as Miller (*13*) found that a speech-to-noise ratio of –18 db (under earphones) is the lowest ratio at which speech can be detected. Under this assumption scores at –20 db speech-to-noise ratio (when listeners viewed the speakers) would indicate the lipreading score of a visually observed oral stimulus. At this speech-to-noise ratio the mean reception scores for vowels and consonants were 44.5% and 72% (see Figures 1 and 2). The order of merit for *vowels* (from highest to lowest scores) was [o u i ʊ e ɪ ɛ], and for *consonants* [p f θ ʃ s k t]. Since different words and phrases were used with each of the four groups of subjects it was not possible to determine reliable recognition values for individual *words* and *phrases*. The mean identification scores for *words* and *phrases* at the

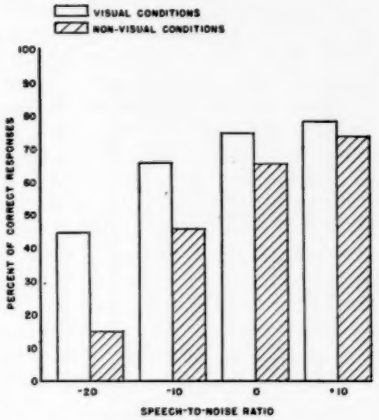

FIGURE 1. Percentage of correct responses to 672 vowels at each visual and auditory level.

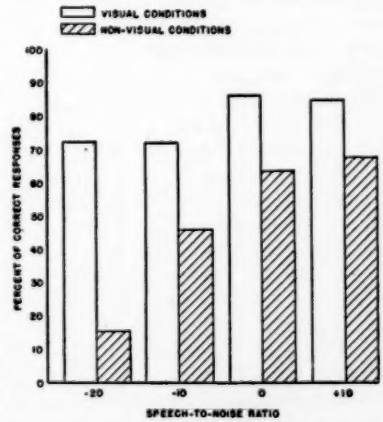

FIGURE 2. Percentage of correct responses to 672 consonants at each visual and auditory level.

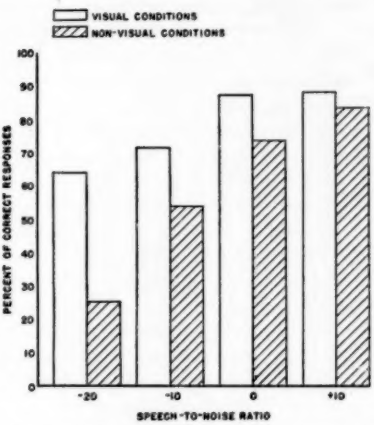

FIGURE 3. Percentage of correct responses to 672 words at each visual and auditory level.

–20 db speech-to-noise ratio (visual) were 64.1% and 25.9% (see Figures 3 and 4). *Words*, as treated in the experiment, might be inferred to be more visible than *phrases*, although the experimental plan did not include a test of the significance of differences between the two kinds of materials.

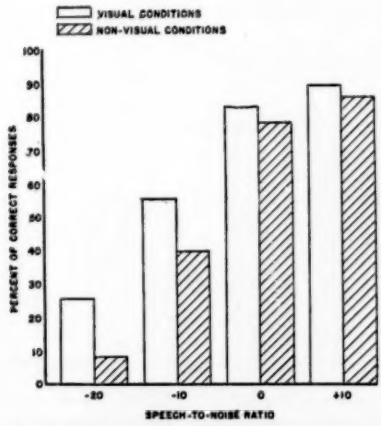

FIGURE 4. Percentage of correct responses to 672 phrases at each visual and auditory level.

If *words* are more visible than *phrases* it is suggested that context in the sense of natural order of words is of no great help in the visual recognition of materials by inexperienced lipreaders. In fact, the additional words may have led to less recognition of materials. Inexperienced lipreaders often complain while viewing a lipreading film that they 'lose their place.'

Several of the lipreading practice manuals attribute certain visibility values to vowels and consonants. One of these manuals, prepared by the WPA lipreading project of the New York City Board of Education (*16*), grouped *consonants* and *vowels* on the basis of graded visibility scores. For the purposes of the present study these *a priori* values were modified in the following manner. The *vowels* with visibility values from zero to .5 [ɪ ʊ ɛ] were pooled in Category I, the one with a value of .75[i] was placed in Category II, while those with values from .75 to 1.0 [u e o] were pooled in Category III. Two major categories were established for the *consonants*. Category I consisted of those *consonants* with visibility values from zero to .5 [k t s]. Category II consisted of consonants with visibility

TABLE 3. Summary of analyses of variance: Measurements of visibility of vowels and consonants at –20 db speech-to-noise ratio.

Sources of Variation	*df*	*Variance*	*F*
Vowels			
Visibility	1	2,709.41	1.97
Listeners	31	686.03	
Remainder	62	1,373.29	
Consonants			
Visibility	1	1,977.47	1.93
Listeners	31	7,643.09	
Remainder	31	1,026.16	

values from .5 to 1.0 [f p θ ʃ]. The variance attributable to visibility for both *vowels* and *consonants* was nonsignificant (*vowels*, *F*, 1.97; 2 and 62 *df*; *consonants*, *F*, 1.93; 2 and 62 *df*). These analyses are summarized in Table 3. There was no apparent correspondence between the relative visibility of either the *vowels* or *consonants* under investigation and the visibility values that are attributed to them by the study of the New York City Board of Education. This could provoke questions about the validity of the relative weightings assigned the *vowels* and *consonants* by teachers of lipreading.

Another rating of the visibility of vowels and consonants was made by the Heiders (*10*). When the present results are compared with these values, certain similarities and differences can be noted (see Table 4). The consonants had numerically higher visibility values (exception [θ]) than those found by Heider and Heider. On the other hand, the vowels appear to have numerically lower percentage values than those obtained by the Heiders (exception [o]). A rank order correlation computed between the two sets of consonant values did not provide evidence of a significant relationship between the two sets of values (obtained *rho* = .58, N = 7). A similar correlation computed between the vowel values showed that there was no significant relationship between the two sets of values (obtained *rho* = .55, N = 7). The differences between the two studies may be attributable to differences in experimental design, type of equipment used, or especially to the types of experimental subjects (untrained normal hearing *vs.* trained deaf children).

TABLE 4. Obtained percentage values for consonants and vowels. Values are compared with those obtained in the Heider study.

	Obtained Values	*Heider Values*
f	83	80
p	83	30
ʃ	73	30
θ	73	90
k	70	60
s	70	60
t	56	40
o	60	50
u	53	90
i	53	70
ʊ	50	70
e	36	50
ɪ	27	60
ɛ	27	30

Aural Reception. In the present study, some of the results may be viewed as being similar to measurements of the effects of noise upon syllable articulation and intelligibility scores. As such, it may then be possible to make a comparison between present findings and those of previous studies. Fletcher (7) extrapolates a set of curves that indicate no articulation score when the speech-to-noise ratio is negative, that is, when there is a higher level of noise than speech. Egan (*5*) reports syllable articulation scores of 30% with 103 decibels of noise at the ear and a speech-to-noise ratio of –3 db. In comparison, as can be seen from Figures 1 and 2, derived from the data of the present study, scores of 15% and 16% were obtained for vowels and consonants at a speech-to-noise ratio of –20 db.

Kryter (*12*) presents a figure that indicates an obtained word intelligibility value of about 38% with a zero speech-to-noise ratio and approximately 4% with a –6 db ratio. From another context, a study using ear wardens, he presents some results with

word reception scores from 58% to 60% accompanying zero speech-to-noise ratios at each of three sound pressure levels. In comparison, Figure 3 depicts scores of 54% at zero speech-to-noise ratio and 25% (chance) at a −10 db ratio.

The speech-to-noise ratios in the present investigation may have been relative to the ones cited above. The speech level was established by the General Radio voltmeter (Series 1800). The ballistic characteristics of this meter might account for the apparently exaggerated differences in articulation scores that attend successive levels of low signal intensity and the apparently attenuated differences in scores between the higher levels of speech and noise. The meter is characteristically sluggish at the lower end of the scale and overshoots at the upper end. Such distortions, if present, would not invalidate any relative comparisons within the study, in that the level of the noise was constant for each condition.

Aural-Visual Reception. By pooling first the four visual and then the four non-visual recognition scores for the vowels and consonants it is possible to obtain approximate *visual-auditory* and *non-visual-auditory* recognition scores for each of the phonemes. As an example of the pooling, in the instance of the vowel [i] all correct responses under the *visual-auditory* condition were totaled, as were the responses for the *non-visual-auditory* condition. This obtained score for the auditory condition (285) was then divided by the total number of possible responses (384) giving the percentage of correct responses (74%). *Vowels* that were both heard and seen were identified 66% correctly, while those that were only seen were identified 50% correctly. Comparable pairs of pooled values were respectively, *consonants*, 76% *vs.* 49%; *words*, 78% *vs.* 59%; and *phrases*, 63% *vs.* 49%. Table 5 lists the *visual-auditory vs. non-visual-auditory* recognition scores for the seven vowels and seven consonants. The vowels [o] and [i] were more consistently recognized than the remaining five at all speech-to-noise ratios. The vowels [u] and [ʊ] had relatively low identification scores at the −20 db speech-to-noise ratio. Apparently these two vowels were difficult to recognize both auditorily and visually. The recognition scores indicate that the [s] is the most audible and [θ] the least audible of the consonants. It appears, in effect, that when vision and audition jointly contribute to the amount of information received, they supplement each other. But the combined effectiveness of the two, when quantified, is less than the summation of their individual contributions to recognition. From the vocabulary of information theory, another description, or explanation, of

TABLE 5. Visual-auditory and non-visual-auditory recognition scores for consonants and vowels. (Four speech-to-noise ratios pooled.)

	Visual-Auditory	*Non-Visual-Auditory*
o	76	51
i	74	59
e	68	57
u	64	43
ʊ	63	39
ɛ	58	51
ɪ	58	49
s	86	71
f	84	40
ʃ	83	53
p	80	41
k	77	46
θ	75	55
t	71	55

this is that there is redundancy in the recognition of sensory signals; that each sensory modality is contributing similar information. As stated previously, the experimental design did not provide for individual analysis of words and phrases. Therefore, comparisons cannot be made.

Effects of Speech-to-Noise Ratios

A second experimental variable that was assessed was that of *conditions* (four speech-to-noise ratios). The mean number of correct identifications of each kind of verbal material increased numerically with each attenuation in noise level, i.e., with each improved speech-to-noise ratio. In other words, as the speech, which was always at a mean sound pressure level of 66 decibels became more and more audible above the noise, the listeners identified more vowels, consonants, words and phrases. The incremental difference in the level of the noise from condition to condition was 10 decibels. The corresponding increase in the number of correct identifications of materials with successively improved speech-to-noise ratio is depicted in Table 2, which presents the change in mean score for the four speech-to-noise ratios.

By subtracting the *non-visual* score from the *visual* score it was possible to obtain a measure of the change in scores produced by vision from level to level. The results are summarized in Table 6.

TABLE 6. Increase in the number of mean (visual) identifications of materials with successively improved speech-to-noise ratios.

	–20 db	*–10 db*	*0 db*	*+10 db*
Vowels	5.98	4.28	2.04	1.10
Consonants	11.94	5.62	4.68	3.55
Words	3.60	3.37	4.19	.38
Phrases	7.96	3.59	2.75	1.06

Vision contributed a smaller increment to the scores under more favorable speech-to-noise conditions than under less favorable ones. In assessing the relative contributions that vision made to the understanding of *vowels* at –20 db and +10 db speech-to-noise ratios, *vision* contributed 5.9 identifications in the mean recognition score or 29%, while at the +10 db speech-to-noise level vision resulted in a change of but 1.1 in mean recognition score, or 5%. In the instance of the other speech symbols the relative contributions at these two extreme speech-to-noise ratios were: *consonants*, 57% *vs.* 17%; *words*, 43% *vs.* 5%; *phrases*, 17% *vs.* 2%. It is apparent that changes in either the auditory or visual channel of communication affect the amount of information that is received by listeners and that visual cues make a relatively greater contribution to the recognition of oral symbols when the noise level masks the speech signal, although more information is always received when the listener watches the speaker than when he does not.

Sound Pressure Levels and Visibility

As an outgrowth of the above findings, additional analyses of variance were computed to determine whether the sound pressure level of vowels influenced their visual recognition. The *vowels* were placed in *strong* and *weak* categories on the basis of the mean relative intensity levels for vowels that were reported by Fair-

TABLE 7. Summary of analyses of variance: Measurements of relationship between the sound pressure level and visibility of vowels.

	Sources of Variation	*df*	*Variance*	*F*
Visual				
	Intensity	1	245.52	1.32
	Conditions	3	15,373.37	82.48**
	Listeners	31	1,594.49	
	L × I	31	154.49	.83
	L × C	93	165.49	.89
	C × I	3	49.58	.27
	L × I × C	93	186.39	
Non-Visual				
	Intensity	1	55.35	.61
	Conditions	3	42,143.92	126.04†
	Listeners	31	1,006.73	
	L × I	31	145.04	1.59*
	L × C	93	255.02	2.80**
	C × I	3	13.28	.15
	L × I × C	93	91.20	

*Significant (*F*) at the 5% level of confidence.
**Significant (*F*) at the 1% level of confidence; C/L × I × C.
†Significant (*F*) at the 1% level of confidence; C/L × C.

banks, House and Stevens (*6*).[1] The vowels [o e ɛ u] were placed in the *strong vowels* category and [ʊ i ɪ] in the *weak vowels* category. Since the two groups differed in the number of components, percentage values were used in the analyses.

The analyses of variance had as sources of variation *listeners*, *intensity*, and *conditions* (see Table 7). The *F*-ratio was non-significant (*F*, 1.32; 1 and 93 *df*). In the instance of non-visual presentation the *F*-ratio was similarly non-significant (*F*, .61; 1 and 93 *df*). Thus it was not possible to reject the null hypothesis that the sound pressure level of vowels does not affect their visual recognition. All of the secondary interactions involving *intensity* were also non-significant. Apparently differences in the intensity of the vowels that were studied did not assist in their visual or auditory (non-visual) recognition. A further comparison was made between the two sets of values, and a non-significant rank order correlation, *rho* = .08 was found between the two arrays of values.

Proceeding on a similar assumption that the sound pressure level of *consonants* may affect their visual recognition, two categories were established —*strong consonants* and *weak consonants*. Fletcher's (7) table of average sensation levels for average funda-

[1]The mean relative db intensity of 11 vowels was given as follows: [æ] 18.3, [ɔ] 17.6, [ɑ] 17.5, [o] 16.8, [e] 16.7, [ɛ] 16.0, [u] 15.7, [ʌ] 14.9, [i] 14.8, [ʊ] 14.1, and [ɪ] 13.8.

mental speech sounds[2] was used as the source of intensity values for the seven consonants. The *strong consonants* group included [s k t], while the *weak consonants* group included [p f s θ]. Since four phonetic elements were represented in one group and three in the other, the responses for each category were pooled in percentages. An analysis of variance with *listeners*, *intensity* and *conditions* as primary sources of variation indicated that there was no significant relationship (*F*) between the intensity of *consonants* and their correct visual identification (see Table 8). The *strong* and *weak consonant* groups were significantly differentiated, however, in respect to non-visual recognition and *intensity* (*F*, 5.65, 1 and 31 *df*). All of the first-order interactions involving intensity (*listeners* and *intensity*, and *listeners* and *conditions*) were also significant at the one per cent level of confidence. Thus it can be assumed that the 'inherent' intensity of consonants affects their auditory recognition. The sound pressure level of the consonants apparently had its maximum effect in auditory recognition at the 0 db speech-to-noise ratio and the +10 db speech-to-noise ratios (non-visual). At these two levels the mean per cent of responses to *strong consonants* was 71.5% and 76.3%. While for *weak consonants* the mean comparable per cent values were 58.1% and 76.3%. Apparently the sound pressure levels

[2]This table includes the average sensation level of 34 sounds, re. .0002 dynes/cm². Values range from 100 db for the vowel [o] to 75 db for the consonant [θ]. The consonants used in this study were ranked according to their average sensation level values in the following order: [ʃ] 91.1 db, [t] 85.3 db, [k] 84.6 db, [p] 81.0 db, [f] 80.7 db, [s] 80.3 db, and [θ] 75.0 db.

TABLE 8. Summary of analyses of variance: Relationship between the sound pressure level and visibility of consonants.

	Sources of Variation	*df*	*Variance*	*F*
Visual				
	Intensity	1	914.84	1.48
	Conditions	3	4,237.89	44.07**
	Listeners	31	1,810.65	
	L × I	31	86.21	1.08
	L × C	93	96.15	1.56*
	C × I	3	877.07	14.37**
	L × I × C	93	61.50	
Non-Visual				
	Intensity	1	1,443.05	5.65*
	Conditions	3	40,547.61	95.01**
	Listeners	31	650.94	
	L × I	31	255.50	2.19**
	L × C	93	426.75	3.66**
	C × I	3	156.00	1.34
	L × I × C	93	116.56	

*Significant (*F*) at the 5% level of confidence; I/L × I.
**Significant (*F*) at the 1% level of confidence; C/L × C.

of the *vowels* or *consonants* used in this study do not play an important part in their visual recognition but differences in sound pressure level do affect the auditory recognition of consonants.

Black (*1*) found that the voiceless continuants had greater amounts of air pressure than the other types of consonants. Of the four voiceless consonants that he studied [p t f s] all but the [t] were identified most frequently in this study. From these results it might be tentatively postulated that pressure differences may assist in the visual identification of some consonants. Fletcher (7) lists [f θ s] as consonants which are difficult to hear, but which are the easiest to interpret by noting the position of the lips; and further:

> On the other hand the vowel sounds which are easier to hear are difficult to interpret from the lip positions. For this reason, hearing and lipreading materially aid each other under those conditions where it is difficult to make proper interpretations.

The findings of this study are in slight disagreement with most of these somewhat *a priori* observations of Fletcher in reference to the particular vowels and consonants studied. Of the seven consonants [p] and [f] were the two most visible consonants, while [s] was the most easily recognized (all conditions pooled), and [f] and [θ] were the least recognizable. In the instance of the vowels, [o] and [u] are the most visible and rank third and sixth in audibility. But the findings of this study are not in disagreement with Fletcher's statement concerning the interaction between hearing and lipreading.

Researches concerning the sound pressure level of consonants have been rather limited. Tolhurst (*15*) found that the voiceless consonants in the initial position usually had fairly well defined recognition thresholds. The [s tʃ ʃ] had well defined recognition thresholds, while [f] and [θ] did not have as clearly defined recognition thresholds as the other five consonants. In the present study both the [s] and [ʃ] were recognized the most frequently, and [f] and [θ] the least frequently. Thus there is substantial agreement between the two studies in respect to the four consonants mentioned above: [s ʃ f θ].

The results of this study appear to indicate, however, that the sound pressure level of the particular *vowels* and *consonants* studied does not play an important part in their visual recognition.

Summary

In evaluating certain communication environments such as those under test in the study the following conclusions may be drawn concerning the contributions of lipreading in the discrimination of 'simple' and more complex information by individuals with normal hearing.

1. Individuals with normal hearing made appreciable use of visual cues (lipreading) to gain information in some communication channels. Visual recognition was always greater than non-visual recognition for all materials under all four of the speech-to-noise ratios employed in the study. Since, at the –20 db speech-to-noise level (visual), listeners were unable to use the auditory channel of communication it was possible to accept the percentage of correct responses at this level as a measure of the amount of lipreading used by the experimental subjects. Such a measurement showed that vision contributed 44.5% to the understanding of *vowels*, 72% for *consonants*, 64.1% for *words*, and 25.9% for *phrases*. The vowels [o] and [u] appeared to be the most

visible, while [p] and [f] were the visible consonants. The vowels [i] and [e] were the most audible of the vowels, while [s] and [t] were the audible consonants.

2. There were significant differences in the visibility and audibility of speech symbols. It would appear that vision had the greatest apparent effect on the identification of *consonants*, and lesser effects, in order, on the recognition of *vowels*, *words*, and *phrases*. There were also significant differences between visual and non-visual identification of these speech symbols.

3. If the auditory channel of communication is employed alone, a high level of noise tends to make communication more difficult. When the visual channel supplements the auditory channel there is an increase in understandability of the *vowels*, *consonants*, *words* and *phrases* that are transmitted.

4. Apparently the sound pressure level of the *vowels* and *consonants* used in this study are not important in their visual recognition. The present visibility values assigned to these particular *vowels* and *consonants* are arbitrary, rather than true values.

The findings of this study can also be described in the terminology of *information theory*. Thus, defects of transmission may be attributed to differences in auditory and visual channals, defects in presentation may be associated with differences in types of materials, and defects in assimilation may be due to differences in the lipreading (speech-reading) ability of listeners.

In light of the above interpretation it might be possible to attribute to the eye, in the instance of *lipreading*, some of the properties assigned to the ear in *hearing*. If so, it would then be possible to suggest that lipreading may be a substitute communication channel.

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The Adaptation Effect In Stuttering And Its Relation To Thoracic And Abdominal Breathing

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THE ADAPTATION effect related to stuttering speech behavior refers to the finding that the frequency of stuttering spasms is reduced during the repeated oral reading of the same passage a number of times. The current report is a second article based on a comprehensive study undertaken to explore adaptive behavior and related respiratory function in adult stutterers and normal speakers.

The previous report (*2*) concerned the relationship between the adaptive behavior of stutterers versus non-stutterers. It included a detailed account of the selection of subjects and a generalized account of the procedure. The results reported in the first study indicated that the adaptation phenomenon was present in both stutterers and non-stutterers although the forms of the adaptation curves were not the same.

The respiratory patterns manifested by stutterers have been the subject of considerable research. It has been a matter of controversy at various times whether stuttering was responsible for faulty breathing patterns or conversely, that faulty breathing patterns were responsible for the stuttering. It would be of significance to stuttering theory to learn whether the adaptation phenomenon in stutterers or normal speakers is accompanied by systematic alteration in respiratory function. The present study was designed to investigate the physiological function of speech adaptation with respect to thoracic and abdominal respiratory activity in stutterers and non-stutterers.

The pertinent literature suggests that an extremely close relationship exists between respiratory factors and stuttering. Steer (*3*), studying the breathing of young stutterers, found that breathing dysfunction during stuttering was characteristic of child stutterers, and observed marked anomalies during the periods of stuttering. Van Riper (*4*), in a study of thoracic breathing of stutterers during expectancy and occurence of stuttering spasms, found that expectancy of stuttering tended to reflect itself in a high inspiration-expiration ratio, and in increased variability. Fossler (*1*) reported that stutterers were 29

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per cent more variable than normals in the duration of inspiration and were 27 per cent more variable than normals in the duration of expiration. Variability in the amplitude of inspiration was but slightly different from the variability in the amplitude of expiration in both stutterers and normals during speech. The findings reported above plus clinical observations and subjective reports of stutterers suggest a relationship between stuttering speech behavior and respiration.

The following questions were considered during the course of this study:

1. What relationship exists, if any, between the adaptation phenomenon and the thoracic and abdominal breathing patterns?

2. What changes in the following respiratory functions are related to the manifested speech adaptation phenomenon:

a. Depth of thoracic inhalation.
b. Depth of thoracic exhalation.
c. Duration of thoracic inhalation.
d. Duration of thoracic exhalation.
e. Depth of abdominal inhalation.
f. Depth of abdominal exhalation.
g. Duration of abdominal inhalation.
h. Duration of abdominal exhalation.
i. Number of complete thoracic breathing cycles.
j. Number of complete abdominal breathing cycles.

Subjects

Forty-four male subjects, 22 stutterers and 22 non-stutterers, matched with respect to age, height, weight, chest and waist circumference participated in this study. There were no significant differences between the two groups on any of the mentioned criteria with the exception of age which was significant between the one and the five per cent points of confidence.

Procedure

At the time of recording, the subject removed all outer clothing above the waist. Pneumographs were placed in position and the subject was seated in an examining chair. The pneumographs were again checked for positioning and operational freedom. The subject was then requested to read a 200-word test passage five times. The passage contained all of the common phonetic speech sounds with the exception of [ʒ].

The pneumograph used for the recording of thoracic breathing was strapped on the subject at the level of the inferior border of the sternum. Another pneumograph for the recording of abdominal breathing was strapped on the subject around the abdomen at the level of the umbilicus. A restraining strap was employed so that the pneumographs could be positioned on each subject with equal tension.

Manning type pneumographs were used in this experiment. The recording instrument employed was the electronic polygraph of the Purdue Voice Science Laboratory. The operation of this instrument is essentially similar to the traditional kymograph method of recording physiological functions.

Respiratory data were collected from individual breathing records for each of the 44 subjects. Measurements of amplitude were taken to the nearest millimeter on a line perpendicular to the base line, between parallel lines delimiting the amplitude or extent of stylus excursion for both

thoracic and abdominal inhalation and exhalation. The base line was the edge of the recording paper. The measurement of amplitude of inhalation was made from the highest point of stylus excursion, the peak of exhalation, to the point of maximum stylus excursion in the opposite direction, the peak of inhalation. The measurement of amplitude of exhalation was made from the lowest point at the bottom of the curve, the peak of inhalation, to the highest point at the top of the curve, the peak of exhalation.

For the measurement of the duration of inhalation or exhalation a template was constructed similar to the one described by Fossler (*1*). A rectangular piece of transparent plastic was cut to the exact width of the recording paper. Upon this plastic were engraved the arcs of the recording styli. This made it possible to measure any point on the breathing curve by following the proper arc downward to the point where it bisected the time base line. Using this method of measurement, the amount of curvature of the stroke of either stylus as it described its upward and downward movements was taken into consideration with appropriate compensation.

The number of complete cycles was the number of inhalations plus exhalations manifested during the time required to read the total passage.

The reliability of independent judges in measuring the breathing records was the degree of agreement among three independent judges measuring the same breathing records. For this purpose the breathing records of five subjects were obtained. These were records of five subjects recorded during the study but not used because they could not fulfill the criteria for matching pairs. Each breathing record was measured independently by every judge five times. An analysis of variance technique was utilized to determine the reliability among judges. From the analysis of variance summarized in Table 1 an agreement coefficient of .99[1] was obtained across the three judges for depth of thoracic inhalation. A coefficient of .99 was also obtained for the other seven variables subject to measurement.

TABLE 1. Analysis of variance table and reliability coefficient of judges for measuring depth of thoracic inhalation.

Source of Variance	*Sums of Squares*	*df*	*Mean Sq.*
Between Judges	0.0083	2	0.0042
Between Subjects	5017.0168	4	1254.2542
Error	0.0384	8	0.0048
Total	5017.0635	14	

The reliability for each judge was considered to be adequate when inspection of the measurements revealed a maximum deviation of one millimeter for amplitude and one second for duration measurements when these measurements were of an average magnitude of 27.6 millimeters and 28.6 seconds.

Results

Thoracic Level. Table 2 and Figure 1 indicate that non-significant differences in the mean depth of thoracic inhalation were found between groups, between trials, be-

[1] $$r_t = \frac{MS_s - MS_{j\times s}}{MS_s + 2MS_{j\times s}} = .99$$

TABLE 2. Analysis of variance for mean depth of thoracic inhalation and exhalation. DI= depth of inhalation; DE=depth of exhalation. Only main effects and error terms for those effects are presented.

Source of Variance		*Sums of Squares*	*df*	*Mean Sq.*	*F*	*Sig.*
Between Groups	DI	.0622	1	.0622	....	N.S.
	DE	.0409	1	.0409	....	N.S.
Between Trials	DI	.1748	4	.0437	1.58	N.S.
	DE	.1335	4	.0334	1.09	N.S.
Groups by Trial	DI	.3203	4	.0801	2.28	N.S.
	DE	.1945	4	.0486	1.17	N.S.
Btwn. Trials for Stutt.	DI	.1633	4	.0408	1.47	N.S.
	DE	.0409	4	.0102	....	N.S.
Btwn. Trials for Non-Stutt.	DI	.3319	4	.0830	2.99	.05-.01
	DE	.2803	4	.0701	2.30	N.S.
Subj. Prs. by Trial	DI	2.3308	84	.0277		
	DE	2.5498	84	.0304		
Subj. Prs. by Group	DI	13.0288	21	.6204		
	DE	14.3524	21	.6834		
Subj. Prs. by Trial by Group	DI	2.9540	84	.0352		
	DE	3.4689	84	.0413		
Total	DI	38.4678	219			
	DE	41.3035	219			

tween groups by trial, and between trials for stutterers. Significant differences were found between trials for non-stutterers.[2]

With respect to depth of thoracic exhalation, Table 2 and Figure 1 also indicate a non-significant difference between groups, between trials, between groups by trial, between trials for stutterers, and between trials for non-stutterers.

Relative to the depth of thoracic inhalation and exhalation, there were no statistically significant differences for the stutterer's group. This sug-

[2]For the *F* calculations in Tables 2 through 6, the following mean squares were used as error terms: Between Groups—Subject Pairs by Groups; Between Trials (Stutterers and Non-Stutterers)—Subject Pairs by Trials; Groups by Trials—Subject Pairs by Trials by Groups.

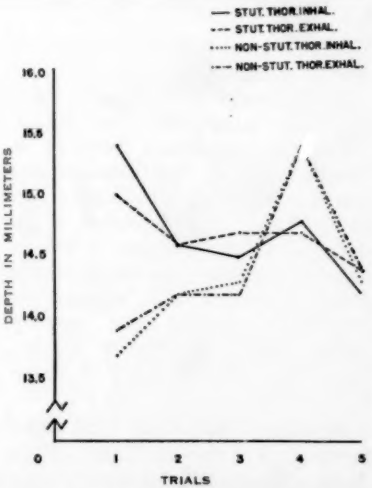

FIGURE 1. Mean depth of thoracic inhalation and exhalation per trial by group.

TABLE 3. Analysis of variance for mean duration of thoracic inhalation and exhalation. DI= duration of inhalation; DE=duration of exhalation. Only main effects and error terms for those effects are presented.

Source of Variance		*Sums of Squares*	*df*	*Mean Sq.*	*F*	*Sig.*
Between	DI	.3441	1	.3441	1.13	N.S.
Groups	DE	.5400	1	.5400	....	N.S.
Between	DI	.1239	4	.0309	2.21	N.S.
Trials	DE	.8721	4	.2180	1.51	N.S.
Groups	DI	.0257	4	.0064	....	N.S.
by Trial	DE	.2625	4	.0656	....	N.S.
Btwn. Trials	DI	.0633	4	.0158	1.13	N.S.
for Stutt.	DE	.9231	4	.2308	1.60	N.S.
Btwn. Trials	DI	.0863	4	.0216	1.54	N.S.
for Non-Stutt.	DE	.2115	4	.0529	....	N.S.
Subj. Prs.	DI	1.1743	84	.0140		
by Trial	DE	12.1414	84	.1446		
Subj. Prs.	DI	6.4549	21	.3074		
by Group	DE	34.4710	21	1.6415		
Subj. Prs.						
by Trial	DI	1.1260	84	.0134		
by Group	DE	10.9740	84	.1306		
Total	DI	12.0677	219			
	DE	80.9078	219			

gests that no significant alteration occurred relative to the depth of thoracic breathing patterns accompanying the adaptation phenomenon. Though non-significant, however, the results for these two variables suggest that breathing pattern alterations in the form of a reduction in the depth of thoracic inhalation and exhalation did occur to a slight degree. Further research with a more homogeneous group (i.e., severity, spasm pattern, exposure to therapy, etc.) should be conducted to clarify this matter.

Significant differences were found between trials for non-stutterers for depth of thoracic inhalation. For the depth of thoracic exhalation, between trials for the same group, the *F* ratio was found to be only 2.30. In order to be significant at the 5 per cent point the *F* ratio would have to be 2.48. It will be noted that the obtained *F* ratio is close to the value needed for significance and it is possible that this value would become significant when testing a larger group. Further research to test this hypothesis should be conducted. From these findings it is suggested that some form of 'inverse adaptation' occurred in the non-stutterers. This 'inverse adaptation' apparently takes the form of an increase in the depth of thoracic inhalation and exhalation.

Table 3 and Figure 2 indicate that with regard to the mean duration of

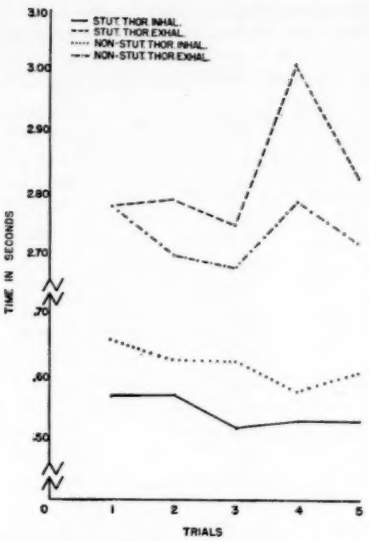

FIGURE 2. Mean duration of thoracic inhalation and exhalation per trial by group.

thoracic inhalation, differences, though non-significant, were found between groups, between trials, between trials for stutterers, and between trials for non-stutterers. No differences were found between groups by trial. With regard to the duration of thoracic exhalation, non-significant differences were found between trials and between trials for stutterers whereas there were no differences found between groups, groups by trial and between trials for non-stutterers.

With regard to the duration of thoracic inhalation and exhalation, no significant alterations occurred accompanying the adaptation effect. Unlike the depth measurements, the duration measurements do not tend to suggest even slight adjustment. For the non-stutterers group there were no significant differences noted. This indicates that no significant alteration occurred in the duration measurements concomitant with the 'inverse adaptation' mentioned above.

Abdominal Level. With regard to depth of abdominal inhalation, Table 4 and Figure 3 indicate that non-significant differences were found between groups, between groups by trial and between trials for stutterers. Differences were found between trials, significant between the .05 and .01 points of confidence. Significant differences were also found between trials for non-stutterers at the .05 points of confidence.

Table 4 and Figure 3 also indicate that similar variations occurred with regard to depth of abdominal exhalation. Non-significant differences were found between groups, between groups by trial and between trials for stutterers. Significant differences were found between trials and between trials for non-stutterers.

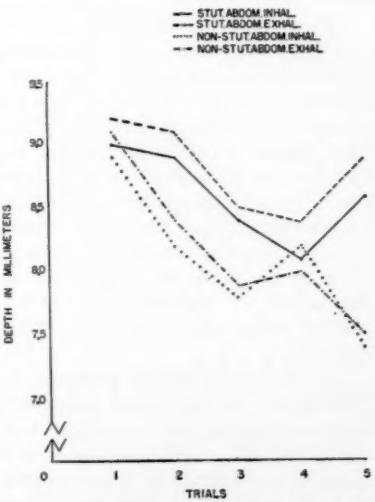

FIGURE 3. Mean depth of abdominal inhalation and exhalation per trial by group.

TABLE 4. Analysis of variance for mean depth of abdominal inhalation and exhalation. DI= depth of inhalation; DE=depth of exhalation. Only main effects and error terms for those effects are presented.

Source of Variance		*Sums of Squares*	*df*	*Mean Sq.*	*F*	*Sig.*
Between Groups	DI	.1477	1	.1477	....	N.S.
	DE	.2392	1	.2392	....	N.S.
Between Trials	DI	.3020	4	.0755	3.16	.05-.01
	DE	.3548	4	.0887	3.35	.05-.01
Groups by Trial	DI	.1225	4	.0306	1.20	N.S.
	DE	.0974	4	.0244	....	N.S.
Btwn. Trials for Stutt.	DI	.1241	4	.0310	1.30	N.S.
	DE	.1226	4	.0306	1.15	N.S.
Btwn. Trials for Non-Stutt.	DI	.3004	4	.0750	3.14	.05
	DE	.3395	4	.0849	3.20	.05
Subj. Prs. by Trial	DI	2.0055	84	.0239		
	DE	2.2239	84	.0265		
Subj. Prs. by Group	DI	20.5473	21	.9784		
	DE	21.5998	21	1.0286		
Subj. Prs. by Trial by Group	DI	2.1300	84	.0254		
	DE	2.1060	84	.0251		
Total	DI	57.3263	219			
	DE	60.8001	219			

With regard to the depth of abdominal inhalation and exhalation there were no statistically significant differences found for the stutterers group. This indicates that no significant alteration occurred relative to the depth of abdominal breathing patterns accompanying the adaptation phenomenon. The results for these variables suggest, however, that alteration in the form of a reduction in the depth of abdominal inhalation and exhalation did occur to a slight degree.

For the non-stutterer's group there were significant differences found for depth of abdominal inhalation and exhalation. This difference took the form of a reduction in depth of the abdominal breathing pattern. These findings combined with the significant difference in increased thoracic inhalation and the near significant difference in increased thoracic exhalation indicate a decided trend toward thoracic breathing accompanying the adaptation effect for normal or non-stuttering subjects. The stutterers demonstrated no significant difference in depth of thoracic or abdominal breathing accompanying their adaptation. The stutterer's group did, however, demonstrate a slight tendency toward reduction in both thoracic and abdominal breathing as opposed to the statistically significant thoracic increase and abdominal reduction shown by the non-stuttering group.

Table 5 and Figure 4 indicate that no significant differences were found for duration of abdominal inhalation or exhalation. It should be noted that similar results were obtained for dur-

TABLE 5. Analysis of variance for mean duration of abdominal inhalation and exhalation. DI=duration of inhalation; DE=duration of exhalation. Only main effects and error terms for those effects are presented.

Source of Variance		*Sums of Squares*	*df*	*Mean Sq.*	*F*	*Sig.*
Between Groups	DI	.4102	1	.4102	1.60	N.S.
	DE	.0008	1	.0008	....	N.S.
Between Trials	DI	.0048	4	.0012	....	N.S.
	DE	1.2843	4	.3211	2.38	N.S.
Groups by Trial	DI	.0275	4	.0069	....	N.S.
	DE	.2569	4	.0642	....	N.S.
Btwn. Trials for Stutt.	DI	.0196	4	.0049	....	N.S.
	DE	.8685	4	.2171	1.61	N.S.
Btwn. Trials for Non-Stutt.	DI	.0124	4	.0031	....	N.S.
	DE	.6727	4	.1682	1.25	N.S.
Subj. Prs. by Trial	DI	2.6380	84	.0314		
	DE	11.3148	84	.1347		
Subj. Prs. by Group	DI	5.3888	21	.2566		
	DE	67.3572	21	3.2075		
Subj. Prs. by Trial by Group	DI	1.8060	84	.0215		
	DE	13.8720	84	.1651		
Total	DI	31.2866	219			
	DE	228.5539	219			

ation of thoracic breathing patterns. The non-significant differences noted with respect to duration of thoracic and abdominal inhalation and exhalation may be due to the inherent nature of the two breathing actions. The fact that speech occurs on exhalation leads to a greater mean variation in exhalation measurements regardless of whether stuttering occurs or not. This greater mean variation makes it necessary for the variation to be extreme before a significant difference is noted.

Table 6 and Figure 5 indicate that, with regard to the mean number of complete thoracic breathing cycles, significant differences were found between groups, between trials, and between trials for stutterers. This indicates that the groups were signifi-

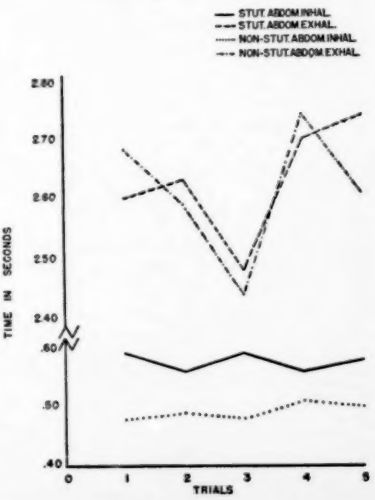

FIGURE 4. Mean duration of abdominal inhalation and exhalation per trial by group.

TABLE 6. Analysis of variance for mean number of complete thoracic and abdominal breathing cycles. T=Thoracic; A=Abdominal. Only main effects and error terms for those effects are presented.

Source of Variance		*Sums of Squares*	*df*	*Mean Sq.*	*F*	*Sig.*
Between Groups	T	36147	1	36147.00	3.29	.05
	A	24889	1	24889.00	2.08	N.S.
Between Trials	T	4527	4	1132.00	3.22	.05
	A	4984	4	1246.00	3.15	.05
Groups by Trial	T	2589	4	647.25	2.02	N.S.
	A	2092	4	523.00	1.23	N.S.
Btwn. Trials for Stutt.	T	6974	4	1698.00	4.81	.01
	A	5573	4	1393.00	3.52	.01
Btwn. Trials for Non-Stutt.	T	321	4	80.25	....	N.S.
	A	1503	4	375.75	....	N.S.
Subj. Prs. by Trial	T	29625	84	352.68		
	A	33224	84	395.52		
Subj. Prs. by Group	T	230893	21	10995.00		
	A	251751	21	11988.00		
Subj. Prs. by Trial by Group	T	26860	84	319.76		
	A	35660	84	424.52		
Total	T	533700	219			
	A	880175	219			

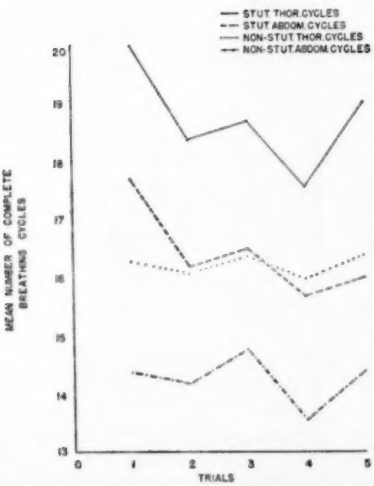

FIGURE 5. Mean number of complete thoracic and abdominal breathing cycles per trial by group.

cantly different in the number of thoracic breathing cycles employed and that the stutterers were highly variable beween trials whereas the normals were fairly constant. Similar results are indicated in Table 6 and Figure 5 with regard to the mean number of complete abdominal breathing cycles with the exception of the non-significant difference between groups.

In addition to the above respiratory data it was noted that significant differences were also demonstrated by both groups in mean total oral reading time. These differences were exhibited in a reduction of oral reading time, being significant at the .01 point of confidence for the stutterers group and at the .01 point of confidence for the non-stutterers group. The differ-

ence between groups was significant at the .01 point of confidence.

Conclusions

Within the limits of the samples studied, the technique and procedure used, the statistical results suggest that the following conclusions may be drawn for this investigation:

1. During successive oral readings of the same passage adult stutterers demonstrate the following statistically significant respiratory alterations accompanying the adaptation effect:

a. Reduction in the number of complete thoracic breathing cycles.

b. Reduction in the number of complete abdominal breathing cycles.

2. During successive oral readings of the same passage adult non-stutterers demonstrate the following statistically significant respiratory alterations accompanying the adaptation effect:

a. Increase in depth of thoracic inhalation.

b. Decrease in depth of abdominal inhalation.

c. Decrease in depth of abdominal exhalation.

3. During successive oral readings of the same passage adult stutterers do not demonstrate a statistically significant alteration in the following respiratory functions accompanying the adaptation effect:

a. Depth of thoracic inhalation.

b. Depth of thoracic exhalation.

c. Duration of thoracic inhalation.

d. Duration of thoracic exhalation.

e. Depth of abdominal inhalation.

f. Depth of abdominal exhalation.

g. Duration of abdominal inhalation.

h. Duration of abdominal exhalation.

4. During successive oral readings of the same passage adult non-stutterers do not demonstrate a statistically significant alteration in the following respiratory functions accompanying the adaptation effect:

a. Depth of thoracic exhalation.

b. Duration of thoracic inhalation.

c. Duration of thoracic exhalation.

d. Duration of abdominal inhalation.

e. Duration of abdominal exhalation.

f. Number of complete thoracic breathing cycles.

g. Number of complete abdominal breathing cycles.

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A Study Of Adaptation And Recovery Of The Stuttering Response In Self-Formulated Speech

Parley W. Newman

PREVIOUS STUDIES (*1, 3, 4, 10*) of adaptation of the stuttering response have appeared to support the conclusion that stuttering may be meaningfully regarded as learned behavior. The learning theory hypotheses proposed by Wischner (*9, 10*) are apparently based on the oral reading performance of stutterers. The question arises as to whether the phenomena of adaptation and recovery of the stuttering response are inherent in stuttering behavior generally or unique to the oral reading situation. Specifically, in successive speaking situations, with communicative speech formulated by the stutterer, are adaptation and recovery of the stuttering response demonstrable?

Procedure

Conditions. In order to make comparisons between self-formulated, communicative speech and communicative oral reading two experimental conditions were employed. These conditions will be referred to as the self-formulated speech condition and the reading condition, respectively. For both conditions descriptions of drawings were employed. Under the self-formulated speech condition, successive self-formulated descriptions of the same set of sketches were obtained from each subject. Under the reading condition successive readings of a passage describing another sketch were obtained.

Subjects were informed that the descriptions would be recorded and later presented to a number of different listeners who would attempt to draw the figures described solely from the recorded directions. It was explained that measures based on the accuracy with which the figures were reproduced by the listeners would be used for the purpose of studying the communicability of stuttered speech.

During the initial session under each of the two experimental conditions, five consecutive descriptions were obtained from each subject. Twenty-four hours after the initial session under each condition a sixth description was obtained from each subject. Subjects were informed for each condition that five descriptions were necessary for purposes of statistical analysis and that the sixth description after the 24-hour interval was to provide a measure of day-to-day consistency. An interval of one week separated the two conditions.

Stimuli to Elicit Speech Samples. A reading passage was prepared for the

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reading condition. The passage described the successive steps to be taken in sketching an hour-glass.

A small booklet containing simple drawings was designed to elicit the self-formulated speech sample. On the first page was a square. The next page contained the square with a circle attached. Each succeeding page contained the drawing of the previous page plus an addition to the sketch until a completed sketch of a toy engine was obtained after several pages had been turned. A second series in the same booklet, employed also in the condition, ended with a sketch of a face. The structure of the booklet required the same descriptive sequence. Closely similar speech samples were thus obtained, both from subject to subject and from trial to trial.

Recording the Speech Samples. The recordings were made with a Magnecorder magnetic tape recorder, type PT-6-J, and an Electro Voice microphone, Model 731. All recordings were made in the same sound-treated room. The subject and experimenter were the only persons present.

Evaluation of Severity of Stuttering. Although the booklet employed in the self-formulated speech condition was designed to elicit similar speech samples with successive descriptions, variation among samples from any one subject as well as variation among subjects was expected. This expected variation made necessary some method for evaluating adaptation other than the usual one based on a frequency count. For this reason, the Iowa Scale of Severity of Stuttering, as developed by Lewis and Sherman (*5*) and further applied by Sherman (7, *8*) was employed to measure the severity of stuttering.

The 240 speech samples were randomized and played back to the experimenter. Every 10 seconds he made a rating of severity of stuttering of the preceding 10-second segment of speech. A rating of *one* indicated least severe stuttering, and a rating of *nine* indicated most severe stuttering. A mean severity rating was computed for each of the speech samples.

Avoidance of previously stuttered words in successive descriptions of the self-formulated speaking condition was possible. Such avoidance could influence the severity measures to increase the apparent amount of adaptation. For this reason measures of consistency of word usage were obtained.

To obtain a sampling of the language behavior with regard to consistency, the first and fifth self-formulated descriptions made by each subject were transcribed. With the transcriptions before him, the experimenter listened to these recorded samples of speech and marked the words stuttered. Henceforth, self-formulated descriptions or readings will be designated as trials.

Observer Reliability. The feasibility of obtaining reliable measures of the severity of stuttering from the ratings of a single trained observer has been established by Sherman (*8*) in an experiment employing 20 three-minute samples of stuttered speech. To provide a means of evaluating reliability of scale values to be obtained from ratings by individuals, measures of severity for the 20 samples were derived from the judgments of two groups of observers. One group consisted of 30 elementary psychology students. The second group consisted of 30 graduate students in speech pathology or psychology. Ratings of severity were made at successive 10-second intervals for each sample. A nine-point scale was used extending from *one*, for least severe stuttering, to *nine* for most severe stuttering.

Two sets of scale values were derived from the ratings by the two groups. The correlation between the two sets of scale values was .99. Either set of scale values should thus be highly satisfactory for use in evaluating the reliability of a single judge.

The 20 speech samples and their established reliable scale values were available to the present experimenter. The procedure set up by Sherman (*8*) for evaluating the reliability of a single observer was followed. The experimenter rated these same 20 samples of stuttered speech in the same manner employed in the Sherman (*8*) study. His mean severity rating for each of the 20 samples was computed. The scale values resulting from the experimenter's judgments were correlated with the scale values established by the group of 30 graduate students of the Sherman study. The correlation between the two sets of mean scale values was .98.

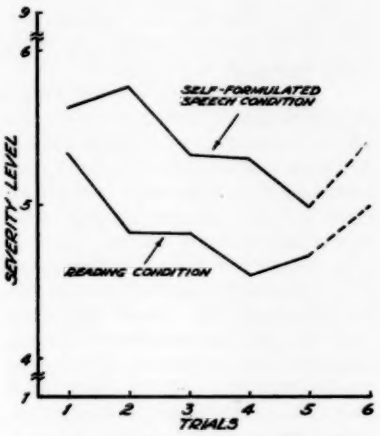

FIGURE 1. Trends of mean severity level for six trials under two conditions. The solid lines connect the means for the five successive adaptation trials. The broken line, connecting the last adaptation trial mean with the recovery trial mean, indicates a 24-hour time interval.

Results

The results of the scaling procedure are represented graphically in Figure 1. The trends of mean severity level for six trials under the self-formulated speech condition and for the six trials under the reading condition are shown. The solid lines connect the means for successive adaptation trials. The broken lines, connecting the last adaptation trial means with the recovery trial means, indicates a 24-hour time interval. Inspection of the trend lines reveals adaptation and recovery in each condition. The self-formulated speech condition is characterized by slightly greater severity of stuttering throughout.

The criterion measure is the average of the ratings of the 10-second segments of any one speech sample. Since there were six trials, two conditions, and 20 subjects, there were 240 criterion measures in all.

An analysis of variance technique was employed to evaluate differences between conditions and among trials. The design utilized was a 'mixed' design which Lindquist (*6*) terms Type VII. The factors used in analyzing the data were conditions (C), the self-formulated speech condition and the reading condition; trials (T), the six descriptions made or read under each condition; and order (O), the order in which the conditions were administered. The order of conditions was counter balanced.

Analysis of the Data. Table 1 summarizes the analysis of the data. Using the five per cent level of significance as a basis for rejecting any null hypothesis the only significant *F*-ratio obtained from the analysis of the data was that for trials. In other words, for conditions combined, the trend of se-

TABLE 1. Results of analysis of variance based upon all 240 criterion measures.

Source of Variation	*df*	*ss*	*ms*	*F**	*P*
Between Ss	19	970.07	51.06		
CO(b)	1	.01	.01	<1.00	NS
error (b)	18	970.06	53.89		
Within Ss	220	348.44	1.58		
Conditions(C)	1	17.89	17.89	1.60	NS
Order(O)	1	19.05	19.05	1.70	NS
Trials(T)	5	11.54	2.31	5.14	0.1
CT	5	3.39	.68	1.17	NS
OT	5	.54	.11	<1.00	NS
CO(b)T	5	1.82	.36	<1.00	NS
error(w)	198	294.22	1.49		
$error_1(w)$	18	201.50	11.20		
$error_2(w)$	90	52.34	.58		
$error_3(w)$	90	40.38	.50		
Total	239	1318.52			

*Error terms: $CO(b) = ms_{CO(b)}/ms_{error(b)}$; $C = ms_C/ms_{error_1(w)}$; $O = ms_O/ms_{error_1(w)}$; $T = ms_T/ms_{error_3(w)}$; $CT = ms_{CT}/ms_{error_2(w)}$; $OT = ms_{OT}/ms_{error_2(w)}$; $CO_{(b)}T = ms_{CO_{(b)}}T/ms_{error_3(w)}$.

verity for trials is significant. Although the two conditions are not significantly different from each other, either in trend of severity or in mean severity, the main interest is in examining any possible differences between the two conditions. As previously mentioned and as shown in Figure 1, the mean severity level for the subjects of this study was consistently higher for all six trials of the self-formulated speech condition than for corresponding trials of the reading condition. The trends of severity over trials also, al-

TABLE 2. Test of simple effects of trials in each condition.

Source of Variation	*df*	*ss*	*ms*	*F**	*P*
Self-Formulated Speech Condition					
Trials(T)	5	7.34	1.47	2.68	5%
error(w)	90	49.28	.548		
Reading Condition					
Trials(T)	5	7.59	1.60	3.14	2.5%
error(w)	90	43.44	.48		

*Error term: $ms_T/ms_{error(w)}$

TABLE 3. Differences among means of trials for the self-formulated speech condition.

*Trial**	*2*	*3*	*4*	*5*	*6*	*Mean*
1	.14	.30	.33	.64†	.22	5.63
2		.44	.47†	.78†	.36	5.77
3			.03	.34	.08	5.33
4				.31	.11	5.30
5					.42	4.99
Mean	5.77	5.33	5.30	4.99	5.41	

*The entry in each cell is the difference between the mean severity levels for the trials indicated in the margins of the table.

†Significant at the 5% level. Critical difference necessary for significance at the 5% level = .46.

though not significantly different from each other statistically, show some marked differences between the conditions for the subjects of this study. Thus, in order to examine possible differences between the two conditions, the data for each condition were analyzed separately. The results of the separate analyses for the two conditions are summarized in Table 2.

Using the five per cent level of significance as a basis for rejecting any null hypothesis, a significant F-ratio was obtained for trials for each condition. The critical difference necessary to establish a significant difference between any two means of the trials was computed for each condition. Table 3 summarizes the differences for the self-formulated speech condition, and Table 4 summarizes the differences for the reading condition.

In the self-formulated speech condition the differences between the means of Trials 1 and 5, 2 and 4, and 2 and 5 were significant. The differences between the means of Trial 5 and Trial 6, the recovery trial, was four-hundredths of a scale value less than the critical difference necessary to establish significance at the five per cent level. An inspection of the plot of trial means in Figure 1 reveals the trend of increased severity from the

TABLE 4. Differences among means of trials for the reading condition.

*Trial**	*2*	*3*	*4*	*5*	*6*	*Mean*
1	.51†	.51†	.79†	.66†	.34	5.33
2		.00	.28	.15	.17	4.82
3			.28	.15	.17	4.82
4				.13	.45†	4.54
5					.32	4.67
Mean	4.82	4.82	4.54	4.67	4.99	

*The entry in each cell is the difference between the mean of severity levels for the trials indicated in the margins of the table.

†Significant at the 5% level. Critical difference necessary for significance at the 5% level = .43.

last adaptation trial (5) to the recovery trial (6). In view of the substantial amount of recovery data now on hand with regard to stuttering behavior, it would be unreasonable to retain the hypothesis of no recovery. In addition, retention of the no recovery hypothesis would be questionable in view of the trend of the curve, along with the lack of any significant difference between conditions.

For the reading condition the trend of adaptation is similar to the trends shown by previous adaptation studies. The difference between Trial 1 and each subsequent adaptation trial was significant. The greatest amount of adaptation occurred between Trial 1 and Trial 4. There was a slight increase of severity with Trial 5. The difference between Trial 4 and Trial 6, the recovery trial, was significant. Hence, in this condition significant amounts of adaptation and recovery were observed.

Consistency Data. For each subject the nouns, verbs, adjectives, and adverbs uttered in Trial 1 of the self-formulated speech condition were listed and counted. A count was also made of these same words repeated in the same context in Trial 5. The ratio between these two counts gave a measure of consistency of word usage for each subject.

For each subject the words stuttered in Trial 1 of the self-formulated speech condition also were listed and counted. A count was made for each subject of the number of these same words repeated in the same context in Trial 5. The ratio between these two counts gave a measure of the consistency of use of words stuttered in Trial 1.

To obtain a measure of adaptation in the self-formulated speech condition, the mean scale value for each subject in Trial 5 was subtracted from the mean scale value for that subject in Trial 1.

The correlation between the adaptation measures and consistency ratios for words stuttered was .04. The correlation between the adaptation measures and the consistency ratios with regard to use of all nouns, verbs, adjectives, and adverbs was −.02. These low, non-significant correlations indicate no relationship between consistency of word usage and amount of adaptation.

Discussion

The results of this investigation provide evidence that the general pattern of adaptation and recovery of the stuttering response is similar in recurring, self-formulated, communicative

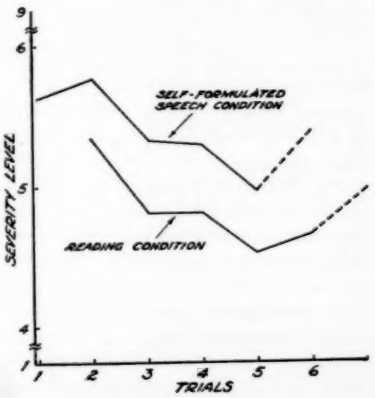

FIGURE 2. Comparison of trends of mean severity levels for six trials under two conditions with the trend line for the reading condition displaced horizontally by one unit. The displacement is to allow comparison of adaptation from Trials 2 through 5 of the self-formulated speech condition with adaptation from Trials 1 through 4 of the reading condition. The solid lines join the means for the five adaptation trials. The broken line, joining the last adaptation trial mean with the recovery trial mean, represents a 24-hour time interval.

speech to that observed in communicative oral reading. Certain differences, however, are apparent (See Figure 1). Adaptation in the self-formulated speech condition did not begin until the third trial. This was unlike the adaptation trend for the reading condition with significant adaptation between Trials 1 and 2, a result similar to the results of previous studies concerned with adaptation accompanying successive readings of the same material. An explanation probably lies in the requirement that the speech be self-formulated. An individual acquires a degree of familiarity with a reading passage on the first of several successive readings. The acquired familiarity with the passage supposedly reduces anxiety with a consequent decrease of frequency and severity of stuttering in the second reading. In the reading condition then, the first reading might be considered a familiarization trial, while in the self-formulated speech condition the pattern of utterance is being formed in the first trial. In the latter condition, therefore, the second trial is probably a trial of editing and revising and at the same time also a familiarization trial, for now the general type of description the stutterer is going to employ should be becoming fairly well established. Hence, in the self-formulated speech condition the subject approaches Trial 3, rather than Trial 2 as in the reading condition, with reduced anxiety as a result of familiarization with the material. The fact that the stuttering in the self-formulated speech condition is more severe than in the reading condition, although not significantly more so, lends support to the above explanation. The speaker can never be as familiar with what he is going to say in succeeding trials as can the reader with the printed sheet before him. If Trial 1 of the reading condition is considered to correspond to Trial 2 of the self-formulated speech condition the adaptation trends for the two conditions are strikingly similar. This is shown in Figure 2 where the graphical representation of the trend of severity for the reading condition is displaced horizontally one unit to the right.

The mean for Trial 5 in the reading condition is greater than the mean for Trial 4. This can probably be attributed to random fluctuation. When passages are read successively the resulting adaptation curve is, in general, negatively accelerating. With the first few trials adaptation is marked, after which the curve tends to level off. In studies such as those of Frick (*2*) and Yensen (*11*), in which the same passage was read more than five times successively, non-significant upward and downward inflections were observed in the later portions of the adaptation curves where adaptation was less marked.

It is to be particularly considered that in the self-formulated speech condition avoidance of previously stuttered words could increase apparent adaptation. From existing data, however, one could also reasonably infer that the attitudes essential to such avoidance would be conducive to the maintenance of anxiety and therefore to a decrease in adaptation. In order to interpret the results for the self-formulated speech condition, it was necessary to determine the correlation between adaptation measures and measures of consistency of word use. The Pearson r was $-.02$. It was also necessary to determine the correlation between adaptation measures and measures of consistency of use of words stuttered in Trial 1; the Pearson r was .04. The evidence is thus strong that avoidance in later trials of words

stuttered in earlier trials had no important influence on the adaptation measures. Furthermore, since the mean of the measures of consistency of use of stuttered words, .62, was slightly greater than the mean of the consistency measures for words representing selected parts of speech, .58, there is no evidence that significant avoidance of previously stuttered words took place. That adaptation, uninfluenced by avoidance of previously stuttered words, occurred under the self-formulated speech condition seems evident.

The question might arise as to whether communicative purpose was maintained by the subjects. Upon completion of the experimental task each subject was asked, 'Did you feel you were actually telling someone how to draw the pictures?' Nineteen of the subjects answered in the affirmative. One subject did not know. Typical of comments made by subjects were the following: 'It's hard telling someone how to draw those things.' 'It makes me mad. If I weren't trying to tell someone how to do this I could just read through it without any trouble.' 'Boy, I'd hate to have to draw from that description.' Apparently the experimental technique employed was successful in maintaining communicative purpose on the part of the subjects in a laboratory situation.

Summary

The purpose of this study was, first, to create conditions in the laboratory such that the speech samples elicited were (a) self-formulated and (b) involved communicative purpose and, second, to examine the nature of adaptation and recovery of the stuttering response under these conditions.

For purposes of comparison two conditions were employed, an oral reading condition and a self-formulated speech condition. The task employed in the oral reading condition was designed to maintain communicative purpose on the part of the 20 stutterers who served as subjects. The subjects were informed that recordings of their readings would later be used by listeners as directions for performing a specific task. Instructions for the self-formulated speech condition were the same except that the speech stimulus was a series of sketches requiring self-formulated oral descriptions on the part of the subjects. The sketches were designed to elicit similar speech samples from subject to subject and from trial to trial. Under each condition five immediately successive speech samples were recorded for each subject. A sixth speech sample was recorded after a 24-hour delay interval.

Severity ratings of the audible characteristics of stuttering by a single trained observer were employed to quantify the data.

Analyses of variance revealed significant amounts of adaptation during the first five trials in each of the two conditions. Recovery, as shown in the sixth trial, in the reading condition was statistically significant at the five per cent level. Recovery in the self-formulated speech condition was very near significance at the same level. The hypothesis of no recovery under this condition was, for various reasons, rejected.

Adaptation in the self-formulated speech condition was not observed until the third trial. Adaptation was marked in the reading condition by the second trial. Possible explanations were advanced for this difference.

The amount of adaptation in the self-formulated speech condition ap-

peared not to have been influenced by the subject's avoidance in later trials of words stuttered in earlier trials.

According to the results obtained, the adaptation and recovery of the stuttering response as found in self-formulated speech are similar to the same phenomena as observed in oral reading.

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A Study Of The Diagnosis Of Stuttering With Special Reference To The Sex Ratio

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THIS STUDY was an attempt to determine whether we have higher standards of fluency for boys than for girls, on the hypothesis that this is a contributing cause of the sex ratio in stuttering.

One of the few unarguable facts about the onset of stuttering is that it takes place more often among boys than girls (*2, 11, 12, 14, 15, 17, 18*). The ratio is a substantial one. Both West (*18*) and Schuell (*15*) have shown that male stutterers outnumber female stutterers by from three to one to about five to one during the elementary school years, the ratio increasing systematically with age during this period and perhaps beyond it. It is not clear to what extent this change in the ratio is due to a progressive increase in the number of boys who acquire stuttering as found by West (*18*), and to what extent it results from the greater tendency of girls to 'outgrow' stuttering reported by Milisen and Johnson (*11*). Since the over-all incidence of stuttering appears to remain fairly stable from grade to grade (*16*) it is probable that both factors are at work. In any case, it is apparent that a sex difference in the incidence of stuttering exists at every age including those early age levels at which the onset of stuttering occurs most frequently. Schuell (*15*) found a ratio of three to one among 105 children who were referred to the University of Iowa Speech Clinic as stutterers between the ages of two and five years.

The source of the sex ratio is obscure. This is less, however, because it is difficult to account for than because it is all too easy to explain on the basis of practically any theory of stuttering. In accordance with an organic theory males may be regarded as more likely than females to possess an inborn constitutional predisposition to stutter by reason of metabolic differences or inadequacies referable to the unmatched 'X' chromosome (*1, 13, 19, 20*). In accordance with an environmental theory, the sex ratio may be regarded as due to differences between boys and girls in any of a variety of developmental factors and cultural influences. Schuell, in a particularly thorough paper on the sex ratio in stuttering (*15*), has pointed out that sex differences extend to such varied conditions as birth injury, sus-

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ceptibility to certain diseases, language development and incidence of behavior problems, and has reported research data showing differences in parental attitudes toward boys and girls.

The hypothesis for this study derives from Johnson's 'diagnosogenic' theory of stuttering (*6, 7, 8, 9*). This theory holds that stuttering is likely to develop when anxious or perfectionistic adults mis-evaluate the common speech hesitancies of childhood as a speech disorder, react to them with disapproval or alarm, and press the child to speak with more fluency than he is able to manage easily and spontaneously. According to this theory stuttering consists of the child's anxious, strenuous efforts to overcome essentially normal interruptions in speech. Johnson considers it to be a cultural phenomenon reflecting society's high standards of speech and of fluency in particular.

At least two explanations of the sex ratio are possible on the basis of this theory. In the first place, boys as a group may be less fluent than girls and consequently more vulnerable to a diagnosis of stuttering in the presence of equally high standards of fluency for both sexes. In the second place, boys may be subject to higher expectations than girls with regard to fluency with the result that they may be misdiagnosed as stutterers more often than girls of equal fluency. These two possibilities are not exhaustive. Nor is it necessary, of course, to think of them as mutually exclusive.

There is some evidence concerning the first of these two factors. In a study of the speech repetitions of 62 two- to five-year-old children, Davis (*5*) found the boys to be less fluent than the girls. The boys averaged 45 repetitions of all types per 1000 words in the course of an hour of spontaneous play as compared to 34 per 1000 words for the girls. The difference lay chiefly in syllable as distinct from word and phrase repetition.

With regard to the second factor there is little evidence. Schuell (*15*), after studying certain aspects of parental policy for boys and girls, concluded that the boy is less sheltered, is forced into sterner competition and experiences more frustrations, conflicts and insecurities which are likely to be reflected in hesitant speech. While Schuell stresses the possible impact of these conditions on fluency, it may perhaps be inferred that parents are correspondingly more anxious about the boy. Schuell also suggests that since the boy tends to compare unfavorably in various respects with the developmentally more advanced girl 'parents and teachers are likely to become concerned, and to exert additional pressure upon him.' Boys may therefore be subject to relatively unrealistic standards of behavior in general. Specific research findings relating directly to standards of fluency for boys and girls are lacking, however.

The object of this study was to determine how far nonfluency is tolerated in the speech of boys and girls as measured by the readiness with which normal children of either sex are diagnosed as stutterers by a sample of adults. In a previous study (*3*), parents of stuttering children were found to make more diagnoses of stuttering than parents of non-stutterers when confronted with a series of 12 two-minute samples of the recorded

speech of young stuttering and non-stuttering children.[1] A reasonable inference is that a test of this kind measures essentially the attitude with which the present study was concerned. Further research (*4*) showed that a series of 34 15-second samples of the speech of non-stuttering children yielded a wide distribution of scores and satisfactory split-half reliability when administered to college students. A similar test was used in the present study. The immediate question with which the study was concerned was whether a group of college students is more prone to diagnose boys as stutterers than girls on a test of this type when the factor of fluency is held constant.

Procedure

Construction of the Test. The experiment presented the problem of eliciting diagnoses which were not influenced by differences in fluency between boys' and girls' speech samples. The method chosen took advantage of the similarity of boys' and girls' voices at an early age. A test was constructed of samples which could not be reliably identified as belonging to either sex. For this purpose approximately 160 15-second tape-recorded speech samples were first collected. The samples, about half of which were available from a previous study (*4*), represented the spontaneous speech of four- to six-year-old non-stuttering children. From among these the experimenters chose 65 which seemed to offer the least clue to the child's sex in the form of speech content or vocal factors. These 65 samples, each separated from the last by a seven-second leader announcing its number, were then heard by a group of 68 college students enrolled in a course in speech disorders. The students received the following instructions:

> You are about to listen to 65 brief samples of the speech of young children. You are to judge in each case whether the voice belongs to a boy or to a girl. On the sheet of paper which you have been given there is a number for each sample which you will hear. Listen to each one carefully. If you are unable to decide whether it is a boy or a girl, place a check mark in the question mark column. Please do not use the 'boy' or 'girl' column unless you are sure you can make a fairly good guess about the sex of the child.

The proportion of 'boy' and 'girl' judgments for each sample was submitted to a chi-square test of the hypothesis that the 'true' proportion was 50:50, Yates' correction for small frequencies being used when indicated. The 30 samples which showed the greatest ambiguity as to sex (smallest chi-squares) in this preliminary study were culled for use in the experiment. These samples, representing 14 different children, were renumbered consecutively from one to 30. They were then divided into two series of 15 samples each. The division was arbitrary, except for the restriction that no child appearing in Series A appear in Series B. Table 1 shows the number of 'boy,' 'girl' and 'undecided' judgments obtained for each of the 30 samples.[2]

[1] The non-stutterers' samples differentiated as effectively between the two groups of parents as did the stutterers' samples.

[2] About half the samples are associated with significant chi-squares. This is actually of little importance. Chi-square in each case is simply a test of the assumption that the students who made 'boy' or 'girl' judgments were drawn from a population of judges who would be divided precisely in the ratio 50:50 in their opinion of the sex of the child. The probability that this assumption is false is not the same as the probability that listeners cannot be induced to regard

TABLE 1. Judgments of 68 college students regarding the child's sex for each of 30 speech samples.

Sample	*Child*	*Judgments*			x^2
		Boy	*Girl*	*Undecided*	
			Series A		
1	A	37	11	20	14.08*
2	B	29	32	7	0.15
3	B	31	31	6	0.00
4	C	15	28	25	3.92*
5	B	25	31	12	0.64
6	B	30	31	7	0.02
7	B	38	18	12	7.14*
8	D	15	38	15	9.22*
9	B	31	34	3	0.14
10	B	31	21	12	3.50
11	E	31	16	21	4.78*
12	B	29	30	9	0.02
13	F	14	28	26	4.66*
14	B	25	36	7	1.98
15	B	34	25	9	1.36
			Series B		
16	G	33	11	24	11.00*
17	H	41	16	11	10.94*
18	I	20	45	3	8.92*
19	J	15	41	12	12.06*
20	K	29	12	27	7.04*
21	L	12	35	21	11.24*
22	H	26	34	8	1.06
23	J	19	38	11	6.32*
24	M	26	18	24	1.44
25	K	36	11	21	13.28*
26	L	29	25	14	0.25
27	N	35	25	8	1.66
28	K	23	6	39	9.96*
29	I	18	42	8	9.60*
30	L	22	20	26	0.09

*Significant at the 5% level of confidence.

the sample as belonging to either sex. Chi-square was used merely as a convenient index of the *relative* ambiguity of a sample. Since chi-square is influenced by the number of cases used, it took into account not only the proportion of boy-girl judgments but, indirectly, the number of undecided responses as well.

The obtained distribution of judgments for each sample shows that each was to a substantial degree susceptible of interpretation as that of either a boy or a girl. On this basis it was assumed that the suggestions given in the experiment would in the main be accepted. This proved to be the case. In systematic discussions immediately after the experiment all but four of the 44 subjects indicated complete belief.

The Experiment. The subjects were 44 students enrolled in four sections of an introductory course in speech at Brooklyn College. They ranged in age from 16 to 22, the mean age being 17.8. For the purpose of the experiment they were divided into two groups, each consisting of 11 males and 11 females.

The two groups were tested separately on the same afternoon. Each group heard Series A and B in the same order. Group I was told that Series A was a series of boys and that Series B was a series of girls. For Group II the suggestions were reversed; Series A was described as girls and Series B as boys. The instructions given to each group prior to the presentation of each series were as follows:

> You are about to listen to 15 brief samples of the speech of young boys (girls) aged four to six. On the sheet of paper which you have been given there is a number for each sample which you will hear. Some of these boys (girls) may be stutterers. Listen to each one carefully. If you think the boy (girl) stutters place a check in the column marked 'stutterer.' If you think the boy (girl) does not stutter place a check in the column marked 'non-stutterer.' Be certain to write your age and sex at the bottom of the page.[2]

[2]The suggestion that some of the children might be stutterers was deliberately made strong in this experiment for technical reasons. With a small number of speech samples in each series there was the danger that some subjects would have zero diagnosis scores for both series, resulting in zero difference between the two measures. Too large a number of zero differences due to zero scores, besides dulling the sensitivity of the test, might have disturbed the assumed normality of the sampling distribution of this difference to the point of invalidating the statistical tests applied to the data. Since this suggestion operated equally for 'boys' and 'girls,' and no meaning was to be attached to an absolute number of diagnoses, the strength of the suggestion was probably of little consequence otherwise.

TABLE 2. Mean number of diagnoses of stuttering made by 22 male and 22 female college students in response to a series of 15 recorded samples of the speech of children described as boys and 15 of children described as girls.

	'Boys'	*'Girls'*	*Combined*
Male Subjects	4.86	4.57	9.43
Female Subjects	3.27	3.09	6.36
All Subjects	4.07	3.83	

The outcome of this procedure was a pair of scores for each of the 44 subjects, one representing the number of 'boys' and the other the number of 'girls' whom he had diagnosed as stutterers. The experiment counterbalanced the effects on this comparison of any difference in fluency between Series A and B, and also permitted a comparison of the over-all scores of male and female subjects.[4]

Results

The results are summarized in Tables 2 and 3. 'Boys' were regarded as stutterers slightly more often than 'girls' by both male and female subjects, all 44 subjects as a group making an average of 4.07 diagnoses of stuttering for 'boys' and 3.83 for 'girls.' The difference was not statistically significant, however, F being 1.21.[5]

A clear tendency, significant at the 1 per cent level, was found for male subjects to make more diagnoses of stuttering than female subjects. This held true for both experimental sug-

[4]The statistical analysis used was that given by Lindquist (*10*) for 'mixed' factorial experiments of the type designated by him as 'Type IV.'

[5]The use of a 'pooled' error term as suggested by Lindquist (*10*), does not appreciably alter the level of significance in this case.

TABLE 3. Analysis of variance of diagnoses of stuttering. 'Sex' refers to sex of subjects, 'suggestions' to the experimental suggestions regarding the sex of the children, and 'series' to sample series A and B.

Source of Variation	*df*	*ss*	*ms*	*F*
Between-Subjects	43	274.90		
Sex	1	51.78	51.78	9.48*
Suggestions × Series (b)	1	0.14	0.14	
Suggestions × Series × Sex (b)	1	4.77	4.77	
error (b)	40	218.21	5.46	
Within-Subjects	44	106.12		
Suggestions	1	1.25	1.25	1.21
Series	1	63.07	63.07	61.83*
Suggestions × Series (w)	0	0.00	0.00	
Suggestions × Sex	1	0.07	0.07	
Series × Sex	1	0.34	0.34	
Suggestions × Series × Sex (w)	0	0.00	0.00	
error (w)	40	41.39	1.03	
Total	87	381.02		

*Significant at the 1% level of confidence.

gestions. For the combined series of 30 samples the mean score of the males was 9.43 as compared to 6.36 for the females.

The very high statistical significance of 'series' shown in Table 3 in all probability reflects a difference in fluency between Series A and B, though this effect is inseparable from that of order of presentation of the two series. A difference between 'series' was taken for granted and is of little intrinsic interest. It may be noted that Series A, first in order, produced an average of 3.10 diagnoses of stuttering as compared with 4.80 for Series B, second in order.

Discussion

This experiment did not furnish sufficient grounds for concluding that college students of the type sampled are more likely to diagnose boys than girls as stutterers on the basis of their recorded speech. An inference readily drawn is that the sex ratio in stuttering is due to factors other than a difference in cultural standards of fluency for boys and girls. If so, the explanation of the sex ratio in accordance with a 'diagnosogenic' theory of stuttering would seem to lie essentially in a sex difference in fluency per se.

Another, perhaps equally reasonable interpretation of the results is possible. This study was concerned by virtue of its design with relative standards of fluency for boys and girls in an abstract, impersonal sense. The emotionalized, self-involved expectations which parents have with regard to their own children may be quite another thing. The two are not completely separable, of course. Specific parental attitudes influenced by

the sex of the child undeniably tend to express broad cultural values which the subjects of this study could be expected to share. Nevertheless, the difference it may make to a college freshman whether a series of speech samples is identified as belonging to boys or to girls is a crude analogue of the difference it may make to a parent that his child is a son or a daughter. For this reason, the hypothesis cannot be dismissed that parents tend to expect more fluency of the boy, that they are more likely to regard his speech interruptions as abnormal, and that, once having made such a diagnosis, they take measures with more determination, vigor and resourcefulness in the case of the boy.

As a by-product of the experiment, male subjects proved distinctly more inclined to make diagnoses of stuttering than females. This was not entirely unexpected. Similar results had been obtained previously with a different series of 34 samples (*4*). Among a group of 55 college men the mean number of diagnoses of stuttering was 10.1 as compared to 7.4 for 86 college women, a difference significant at the .01 per cent level of confidence. There is evidently a sex difference on the college level in standards of fluency for young children as measured by this type of test. What meaning is to be attached to this? While any answer is a guess, a plausible interpretation may be made. It does not seem far-fetched to regard a subject's diagnosis score as describing his personal standards of fluency in a rather general sense, and therefore as revealing in some measure the value he attaches to fluency in his own speech. The more acute sensitivity of male subjects to the nonfluencies of children may well mean a lower tolerance for their own speech hesitations. Schuell (*15*) observes:

> It may be that males are more prone than females to react with hesitation and tensions in situations in which a premium is set upon fluency, as it seems to be in many classrooms, discussion groups, and extra-curricular activities. The male student may be more prone than the female to evaluate himself in terms of his ability to compete with other students in such situations, which may accentuate fears and anxieties regarding speech. It seems possible at least that girls evaluate themselves less often in these terms. . .

A sex difference precisely of this nature may be reflected in the diagnosis scores of male and female college students. If so, the possibility that this has some relevance to the sex ratio in stuttering should not be ignored. A crucial question is whether such a sex difference in standards of fluency exists among children. In a study of parents of stutterers and non-stutterers (*3*) no difference in diagnosis scores was found between the mothers and fathers. Further research is needed with relatively young subjects. It is possible to imagine a sex difference in standards of fluency extending backward into childhood and diminishing with maturity. It need hardly be added that such a sex difference, if it exists, could scarcely occur in the absence of the very cultural pressures for boys as contrasted with girls which formed the hypothesis for this study.

The two essential findings of this study were first, the slight tendency, within the limits of expected chance variation, toward higher diagnosis scores for 'boys,' and second, the higher scores of male subjects. Whatever inferences are drawn from them, it must not be overlooked that this was, first and last, a study of college students. Insofar as these two findings have any implications regarding a

hypothetical parent-child relationship, it was a college student who in the first instance served in place of the parent, and in the second, in place of the child. Considered from this standpoint, the results of this study were far from direct observations. The possibility cannot be tossed aside that these findings provide faint intimations of the same thing, seen at remote range from two different points of view.

Summary

The purpose of this study was to determine whether the sex ratio in stuttering can be attributed to a difference in standards of fluency for boys and girls. The test materials were two series of samples of the recorded speech of normal speaking young children. Both series were composed of speech samples previously determined to be relatively ambiguous as to the sex of the child. The subjects were two groups of college students. Both groups were instructed to indicate the numbers of any samples which they regarded as belonging to stutterers. Group I was told that Series A belonged to boys and Series B to girls. Group II was told that Series A belonged to girls and Series B to boys.

The subjects diagnosed slightly but not significantly more 'boys' as stutterers than 'girls.' Male subjects made significantly more diagnoses of stuttering than female subjects.

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A First Step In The Evaluation Of Stuttering Therapy

Robert Schaef
Jack Matthews

IT HAS BEEN said ' . . . the college sophomore is the raw stuff out of which psychologists (are building) . . . a science of human behavior' (2). In speech correction we are one more step removed from men-in-general than the above mentioned psychologists. Decisions as to what is 'normal' or 'abnormal' speech are made by professionals with a strictly professional point of view. The problem of the suspected discrepancy between the opinion of experts and men-in-general regarding speech defects has yet to be explored. Part of the present study is concerned with the difference between judgments made by expert and by naive judges as to the amount of progress made by stutterers in therapy.

The general aim of this study is to explore some of the problems which arise in connection with an attempt to evaluate a clinical program in speech therapy, and to determine the relative reliability and validity of certain alternative methods to be used in arriving at a sound evaluation. A satisfactory evaluation program would involve several measurements depending on the type of defect. For example, with stutterers some type of pre- and post-therapy measurement of personality adjustment might be considered important. In all cases, however, we are concerned with how much the defect itself has been modified. It is with one portion of this modification that this study is concerned, namely, the heard or audible aspects of stuttering speech. It should not be inferred from this, however, that modification of the symptomatic speech defect is necessarily the most important measure of success in a speech therapy program. This aspect of the problem is taken as a starting point because of the common speech clinic practice of making recordings at the beginning and at the close of therapy. Such recordings offer a highly practical source of data for evaluating progress made in therapy. The assumption that these available data, viz., paired recordings for each subject, will reflect the progress or regression as a result of therapy is an untested one, and one of the conclusions of the study will be concerned with the validity of judgments based on samples of recorded pre- and post-therapy stuttering speech.

The formal hypotheses to be tested are three in number and can best be

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stated in the form of questions to be answered: First, when changes in recorded stuttering speech are the stimuli to be judged is there a significant difference in the inter-judge agreement obtained for naive as compared with expert judges? Second, is there a significant difference between naive and expert judges in the accuracy, or validity, with which the judgments are made? And third, what is the effect of using various criteria, in the form of directions to the judges, on the measures of agreement and validity, for each group of judges, naive and expert? It can be seen that the first two questions are concerned, in part, with the availability of judges. That is, expert judges are hard to find; it would be desirable to have adequate judges available in large numbers. The last question concerns the criteria of severity of stuttering. That is, what aspect of the recorded defective speech do the judges most agree makes the speech defect more or less severe?

The subjects were 20 stutterers whose speech problem was so severe so as to handicap them vocationally in the opinion of the Pennsylvania Bureau of Vocational Rehabilitation. Within the group, however, they ranged from mild to very severe.

The recorded material was a paragraph which includes all the sounds of the English language and takes about 18 seconds for the typical speaker to read aloud. No sample on any single record exceeded 25 seconds whether the paragraph was completed or not. The pairs of records, pre- and post-therapy, were randomized with respect to the subjects; and then randomized with respect to which came first in each pair, the pre- or post-therapy record. They were then dubbed on a recording tape in the following manner: 'This is record number one of the first pair'—followed by speech sample; 'and this is record number two of the first pair'—followed by speech sample; 'Will you make your rating now please'—followed by 10 seconds of silence to allow for judging; 'This is record number one of the second pair'; and so forth through the 20 pairs. The whole tape took approximately 25 minutes to play. The ratings were made on especially prepared forms with the instructions at the top. These instructions were read aloud to the judges before each set of judgments was made.

The five expert judges are all presently engaged in work which requires that they make statements concerning the progress of speech defectives in therapy; they all had had at least 1000 hours of clinical experience with speech defectives; and none had had any contact, in a therapeutic situation, with the subjects. The five naive judges were all volunteers, one from each of five sections of a sophomore psychology class; none was a stutterer nor had a stutterer in his immediate family; and none had taken any course in which study of defective speech was regularly made.

The group of expert judges were assembled and directed to rate the second record in terms of the first of each pair as being 'much better,' 'slightly better,' 'the same,' 'slightly worse,' or 'much worse.' They were to use their own criterion or criteria in arriving at their decisions. This set of instructions we shall call Condition 1. At one week intervals these expert judges were asked to perform similar tasks two more times. The second time they were presented with the same stimuli and three of them were asked to rate on the same type of

TABLE 1. Inter-judge correlations for two groups and three judging conditions.

		Experts					*Naive group*				
	Judge	*1*	*2*	*3*	*4*	*5*	*Judge*	*1*	*2*	*3*	*4*	*5*
Condition 1	1		.74	.38	.37	.46	1		.56	.68	.66	.46
	2			.64	.57	.61	2			.69	.51	.77
	3				.62	.72	3				.81	.84
	4		M = .55			.29	4		M = .68			.65
	5						5					
Condition 2	1		−.45	.24	.71	.64	1		.70	.51	.62	.59
	2			−.56	−.57	−.58	2			.87	.73	.80
	3				.89	.69	3				.59	.74
	4		M = .25			.71	4		M = .70			.66
	5						5					
Condition 3	1		.43	.46	.55	.46	1		.62	.60	.59	.46
	2			.67	.61	.49	2			.61	.67	.86
	3				.82	.76	3				.88	.61
	4		M = .62			.73	4		M = .68			.67
	5						5					

scale the change in the amount of tension in the voice. This is Condition 2. The other two expert judges rated the change in the amount of unfavorable attention the speech called to itself. This is Condition 3. The third time the expert judges assembled the two who rated the change in unfavorable attention the week before rated the amount of tension this time, and the three who rated the amount of tension the week before rated the amount of unfavorable attention this time. This was done in order to secure a counterbalanced order of the conditions with an odd number of judges. On the same days but at different times the group of five naive judges went through the same procedure as outlined above for the expert judges.

These particular aspects of stuttering were chosen to be rated because of their acceptance by experts in the field of speech correction as being part of the definite symptomatology for that type of speech. Van Riper (*3*) in defining defective speech includes the criterion 'Speech is defective when it deviates so far from the speech of other people that it calls attention to itself.' And further on, when he outlines a therapy for stuttering, one of the goals of therapy is listed as, 'Teach the stutterer not to avoid fears or blocks, but to use them in learning how to stutter in an *easy*, *effortless* fashion, with a minimum of interruption or abnormality' (italics ours).

Measures of inter-judge agreement, in the form of product moment r's, were computed for the expert and the naive groups of judges under each of the judging conditions one, two, and three. Intercorrelating each judge's ratings with those of the others in the same group yielded 10 intercorrelations for each judging condition. These correlations and the mean correlation for each condition are seen in Table 1. It can be seen that judge number 2 in the expert group

TABLE 2. Analysis of variance summary for inter-judge agreement.

Source of Variance	Sums of Squares	df	Mean Square	F	Tabled F .01	Tabled F .05
1 Between groups	.978	1	.978	5.041	8.28	4.41
2 Between z scores* (same group)	3.484	18	.194			
3 Total between z scores	4.462	19				
4 Between criteria	.128	2	.064	.413	5.25	3.26
5 Criteria × groups	2.238	2	1.119	7.219	5.25	3.26
6 Pooled z scores × criteria	5.583	36	.155			
7 Total within z scores	7.949	40				
Total	12.411	59				

*These scores are inter-judge correlations which have been transformed using Fisher's formula (2).

contributed four negative correlations under Condition 2, the amount of tension in the voice. This particular expert was used previously as a judge in another study, and gave ratings which were, in general, in disagreement with his fellow judges. It is the writers' hypothesis that this disagreement can be explained by the theoretical position this expert holds, based on his background and training, with regard to what constitutes the stuttering symptom. If this hypothesis is true, we would expect that this type of disagreement would be more liable to occur in an expert group than in a naive one, and on the more specific criteria in Conditions 2 and 3. From a glance at Table 1 we can see that the naive group yielded a more homogeneous set of *r*'s as well as slightly higher ones.

These *r*'s were then translated into *z*-values to facilitate their use as scores in an analysis of variance technique. These will be referred to as 'scores.' This method of analysis (*1*) allowed making three comparisons: First, a comparison of the naive and the expert groups with the scores for each of the three conditions pooled. Table 2 is the variance summary for inter-judge agreement. The *F* obtained was significant at the .05 level and fell just short of significance at the .01 level in favor of the naive group (Table 2, line 1). This means that the naive judges, as a group, gave more homogeneous ratings to the extent that the intercorrelations of these ratings, pooled for all three conditions, were significantly larger than those of the experts. This would suggest there is limited value in troubling to secure the less available expert judges when judgments of the sort used in this study are to be made. In fact it might be more to the point to have the stutterers judged by lay-persons of the type he will meet in everyday life.

A second comparison made was that among the scores obtained under the three conditions with the scores of the expert and naive groups under each condition pooled. The *F*-ratio did not reach the .05 level of significance (Table 2, line 4). Under none of the specific directions to the judges, then, were statistically higher inter-judge reliabilities produced than ask-

TABLE 3. Correlations between clinician's and judges' ratings.

	Expert group *Condition*				*Naive group* *Condition*		
Judge	*1*	*2*	*3*	*Judge*	*1*	*2*	*3*
1	.64	.43	.35	1	.38	.46	.49
2	.64	−.57	.40	2	.25	.67	.29
3	.54	.83	.57	3	.47	.50	.26
4	.48	.71	.54	4	.69	.65	.45
5	.34	.54	.47	5	.37	.55	.36
Mean	.54	.46	.47	Mean	.45	.58	.40

ing the judges to use their own criterion or criteria. This last mentioned set of directions would be the choice for further research on the basis of simplicity.

The third comparison made, interaction between the two groups and the three conditions, gets at the question of whether either of the groups under any one condition produced inter-judge correlations significantly different from the other group under the same condition or the other two conditions. The *F*-ratio was significant way beyond the .01 level (Table 2, line 5). A glance at the tabled data suggests that the low mean *r* for the experts under Condition 2 is probably the largest contributor to this highly significant *F*. Tests between the experts under Condition 2 and the naive group under each of the conditions separately indicate the differences were significant beyond the .01 level. The next highest difference between means, the experts under Condition 1 and the naive group under Condition 2, failed to meet the .05 level of significance when tested individually by the *t* technique.

The ratings of the clinicians who originally handled the subjects in

TABLE 4. Analysis of variance summary of validity measurements.

Source of Variance	*Sums of Squares*	*df*	*Mean Square*	*F*	*Tabled F .05*
1 Between groups	.002	1	.002	.019	5.32
2 Between *z* scores* (same group)	.816	8	.102		
3 Total between *z* scores	.818	9			
4 Between criteria	.061	2	.031	.044	3.55
5 Criteria × groups	.688	2	.344	.493	3.55
6 Pooled *z* scores × criteria	1.118	16	.698		
7 Total within *z* scores	1.867	20			
Total	2.685	29			

*These scores are correlations between judges' and clinician's ratings which have been transformed using Fisher's formula (2).

therapy were thought to afford a criterion of validity and were secured on the same five-point rating scale. They were asked to consider heard speech only. When these ratings were correlated with similar, independently obtained ratings made by the clinic director an r of .79 was obtained. Product moment r's were computed between the ratings of the clinicians and those of the judges under each of the three conditions. Table 3 gives the obtained r's for this 'validity' measurement and the means for each condition.

Using the same analysis of variance technique, and making the same three comparisons as outlined above for the judge reliability data, we find insignificant F ratios. That is, the 'validity' with which the judgments were made did not vary in a statistically significant manner, from group to group, from condition to condition, nor for either group under any one condition from the other group under the same or the other conditions. While these correlations are low, all but one are positive, which indicates they are not chance values.

Summary

The pre- and post-therapy recordings of 20 stutterers, randomized as to which of the pair came first, were dubbed on a recording tape in a random pair order. The tape was presented at weekly intervals, three times each to an expert and a naive group of judges. The former were five clinicians, each with 1000 clinical hours experience, presently engaged in speech correction work, while the latter were five college sophomores. At each presentation they were asked to rate on a five-point scale the amount, and direction, of change in each pair of records with respect to: (1) the severity of stuttering using their own criterion or criteria; (2) the amount of tension in the voice; and (3) the amount of unfavorable attention the speech calls to itself. Inter-judge correlations for each group of judges under each of the three conditions were computed. These correlations were translated to z values and submitted to an analysis of variance technique which provided for the testing of significance between the groups, between the conditions, and interaction between them. Using the ratings of the original clinician who handled the subject in therapy as the outside criterion, 'validity' coefficients were computed for each judge under each condition. These correlations were also translated to z values and submitted to the same analysis of variance technique.

Concluding it can be said:

1. Inter-judge r's for the naive group were found to be significantly higher than those for the experts.

2. The inter-judge r's for the two groups combined were not affected by varying the directions as to what to judge.

3. Disagreement among the experts as to what constitutes tension in the voice was such as to significantly depress the average intercorrelation for the expert group when judging this aspect of stuttering speech.

4. The validity with which the ratings were made, using the original clinician's ratings as the validating criterion, was uniform from group to group, from criterion condition to criterion condition, and with respect to interaction between group and condition.

5. The 'validity' coefficients, although uniformly low, were not such that they could be considered chance

departures from zero. Thus samples of recorded stuttering speech do in some measure reflect clinical opinions about the changes that occur during therapy.

From a practical point of view the results of the study indicate that naive judges may be used with confidence that no greater validity and inter-judge reliability would be obtained through the use of the less numerous experts. Furthermore, it is indicated that the simple criterion of 'change in severity' yields results as satisfactory or better than more explicitly described criteria.

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An Integration Of Psychotherapy And Speech Therapy Through A Conflict Theory Of Stuttering

Joseph G. Sheehan

PSYCHOLOGICAL approaches to stuttering have centered largely on two assumptions: (1) stuttering is a habit, or in more elegant modern phrasing, learned behavior; (2) stuttering is a symptom of neurosis. Those who have assumed the disorder to be primarily learned behavior have focused upon speech therapy; those who have assumed it to be symptomatic of deeper problems have emphasized psychotherapy.

Many procedures commonly employed in speech therapy with stutterers appear quite different from, if not actually contrary to, principles of conventional psychotherapy. The speech therapy approaches of Van Riper (*17, 18*) and of Johnson (*9, 10*), for example, frequently involve a certain amount of rather didactic mental hygiene, 'objective attitude' instruction, or teaching of the semantics of personal adjustment. There is considerable utilization of challenge and direct work on the stuttering behavior itself, and the therapy may be built largely around 'assignments' or the performance of tasks. Van Riper's 'To the Stutterer as He Begins . . . (*19*), conveys the impression that the stutterer must climb the rungs on a ladder, and if he is incapable of making the grade, he will be dismissed from therapy. However effective Van Riper's approach is in practice—and the author can speak for the fact that it is—it is clearly at variance with what psychotherapists ordinarily do.

The procedures of speech therapy are likely to be viewed with suspicion by those fond of echoing that with stuttering, as with any neurosis, we must 'ignore the symptom' and work only on deeper underlying problems. Therapists who attempt to treat stuttering simultaneously as a habit and as a neurosis sometimes find themselves working at cross purposes.

Are these approaches necessarily in conflict with each other, or can they be reconciled and integrated within a single theoretical system?

The central thesis of this article is that psychotherapy and speech therapy do not need to be in competition, but can have a common goal. This basic goal follows logically from the author's theory of stuttering as an approach-avoidance conflict (*12, 13, 14*).

Approach-Avoidance Conflict Theory

According to this theory, stuttering is the result of a conflict at various levels between opposed urges to approach and to avoid the act of speaking. The stutterer stops or oscillates whenever these opposing forces reach

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an equilibrium; the primary symptoms of prolongation and repetition are produced in this manner. The occurrence of the overt blocking reduces fear and avoidance sufficiently to disturb the equilibrium, release the block momentarily and enable the stutterer to continue.

Since the avoidance of the stutterer is based on fear, stuttering is to be treated basically as a fear problem. Success in treatment then requires gaining a mastery over fear and finding an expression of whatever needs, feelings, and tendencies have been locked up in the symptom.

The approach-avoidance conflict responsible for stuttering may occur at different levels: word, situation, emotional content, relationship, and ego protective. The blocking in speech may reflect a conflict between speaking or not speaking a feared word, meeting or avoiding a threatening situation, expressing or inhibiting unacceptable feelings, accepting or rejecting certain social roles or interpersonal relationships, and entering into or retreating from certain lifelong endeavors, aspired roles, and other competitive callings (*14*).

Word fears and situation fears and the attitudes surrounding them are the concern of speech therapy. Feelings, relationships and defenses are reached through psychotherapy. In each case the basic goal of treatment is the same: to reduce the 'holding back' behavior, the fear and avoidance responsible for the stutterer's conflict.

Through the analysis of levels of conflict, therefore, approach-avoidance theory permits the rapprochement of: (1) learning theory and psychodynamics on the one hand; (2) speech therapy and psychotherapy on the other. In parallel form these represent the theory and the treatment of stuttering.

Current clinical practice on the treatment of stuttering may vary all the way from a mechanical approach which stresses phonetic factors or relaxation rituals (7) to purely verbal systems which hinge on client-centered or psychoanalytic therapy (*4, 5, 8*). Despite the mechanical character of some approaches, however, the stutterer's need for psychotherapy is now widely recognized and generally accepted.

The levels at which the approach-avoidance conflicts occur point to the problem areas in which psycotherapy is needed (*14*). So long as the stutterer's speech is adversely affected by certain emotional content, his feelings contribute to his problem, and he has need for more adjustive, adaptive expression of these feelings. If the stutterer blocks more in certain necessary life roles, e.g., in the presence of father figures, he needs to find new and more satisfactory relationships with such figures. So long as the stutterer has defensive needs, and is affected in these ways, he can profit from psychotherapy.

Why Is Speech Therapy Necessary?

To many modern clinicians, especially psychiatrists and psychoanalytically oriented psychologists, speech therapy with stutterers does not make sense. They are likely to think it symptomatic, superficial, and problem oriented. They argue, since stuttering is the expression of a deep inner need, why work on the speech at all? They note that we do not deal directly with the neurotic behavior itself in the case of other neuroses, but indirectly, through expression of feelings, development of insight, establishment of new relationships, and the like.

At the same time, we may be pardoned for observing that the success

of psychotherapy alone with stutterers, even as practiced by the most able of these clinicians, has been far from impressive. Most of these therapists see a relatively small number of stutterers as part of their general practice, and are likely to ascribe their lack of success to the singular resistances of the stutterer. The number of stutterers they deal with is small enough so that they never come to grips with their high failure ratio.

Those who specialize in working with stutterers seldom confine their efforts to psychotherapy alone, are seldom content with a talking cure; they include some direct work with the stuttering behavior itself and the attitudes which have been built up around it.

Is speech therapy with stutterers necessary? The author's answer is that any program of psychotherapy with stutterers is incomplete without it. The kind of help the stutterer can gain only through direct speech therapy should be made available to him, and nothing is gained by denying him access to it. The principal reasons for the inclusion of speech therapy in a program of psychotherapy for stuttering are set forth below:

First, in the symptom of stuttering the conflicts of the stutterer are externalized and given outward expression. The blocks the stutterer has and his reactions to them portray his self-perceptions, his attitude toward his disorder, his mechanisms for handling anxiety, and many significant aspects of his personality. Each time the stutterer has a block, he is reliving in a small way one of the most significant experiences of his life—that of finding himself blocked and unable to express himself through speech. Why seek to ignore the occurrence of this important event, which intrudes itself so conspicuously into the therapeutic situation? The blocking which occurs in the therapeutic situation is an important index of the whole relationship between the stutterer and his therapist. Moreover, the stutterer's whole struggle to meet life and to conquer his fears and blocks is a necessary part of any therapy which respects the stutterer's own desires and feelings. It is better, then, to begin where the stuttering occurs and to work back through the unsatisfactory relationships producing the conflict. The latter process is basic to any psychotherapy, and speech therapy facilitates it for the stutterer.

Second, a large part of the stutterer's fear stems from the guilt the stutterer feels at punishing others with his unpleasant and socially unacceptable speech. Through speech therapy we are able to create an attitude of extreme permissiveness toward the stuttering, even encouraging the expression of the symptom through 'negative practice' techniques and faking or voluntary stuttering. Society has punished the stutterer for the stuttering, and since speech is such an important tool of social adjustment, the secondary effects of stuttering are perhaps more important than those of any other neurosis. In modern speech therapy with the stutterer, when the therapist encourages the expression of the stuttering he thereby accepts responsibility for what happens to the stutterer's audience. If the stuttering can be viewed as an aggression against the listener, then the stutterer is given support in the systematic expression of his aggressions toward the listener, with the therapist assuming the major portion of the guilt. Speech clinics throughout the country are able to provide stutterers with enough social and group contact with other stutter-

ers so that they feel less guilty and isolated. They hate less the role of stutterer and are more willing to accept it.

Third, stutterers may undergo profound personality changes as a result of successful speech therapy, and the speech therapy itself is an important specialized form of psychotherapy. When a stutterer learns how to handle his fears and his blocks, develops healthier attitudes toward his problems, toward himself and toward others, he changes fundamentally in his personality.

Fourth, encouraging the stutterer to attack feared and difficult situations may support him strongly in something he has really wanted to do. Many stutterers relate that they get tired of running away; it is a deeply moving experience to master situations from which they have always retreated. Some of the best successes have been obtained with cases who had little overt stuttering to begin with and who underwent no discernible changes in speech. But through speech therapy, with very little insight oriented psychotherapy, the stutterers have been freed from many of their conflicts and problems.

Fifth, all stuttering, at least in the secondary stage, involves some degree of learned behavior. For many adult cases the original causes may have ceased to operate, and the disorder becomes self-maintaining or functionally autonomous (*2*, *3*, *17*, *18*). If a therapist uses nothing but verbal techniques to cope with this self-maintaining behavior system, the stutterer is left helpless to deal with the cues which characteristically elicit the behavior. The stutterer needs to learn how to handle fear, not just how to avoid it.

Sixth, if no direct speech therapy is used, then whenever the stutterer hits a low mood or a period of upset, this is going to be reflected inevitably in his speech, so that his social and vocational handicap may return at any time in full force. On the other hand, it appears to be possible, through speech therapy, to teach stutterers more adequate modes of response to old fear-inducing situations, to teach them how to handle themselves in the presence of fear and other upsetting emotional states. Through speech therapy then, it is possible to teach the stutterer a mode of handling his problem which may be relatively independent of the way he feels at the moment. If a stutterer does not have this capacity, he will be the victim of every change in mood and every future upset in his life.

Finally, when the speech therapist supports a stutterer in facing his problem and helps him to face it, he removes the reinforcement inherent in its ego-protective functions. The stutterer is no longer able to escape from society. He can no longer use his symptom to avoid threat of failure, and the stuttering loses its primary function. If the person cannot face his problems to this extent, and if he is too seriously disturbed to profit from speech therapy, the stutterer's reaction to speech therapy will reveal the source, nature and extent of his resistance. By offering him new and better means for dealing with his problem, the speech therapist gives the stutterer an opportunity to break out of the vicious circle. Some stutterers appear to need little more than this to make a successful recovery. Those who do not or who cannot profit from the new tools thus proffered, thereby establish a focal point for the analysis and understanding of their resistance. In this respect, speech therapy is an

important early step to deeper psychotherapy. If the stutterer is too seriously disturbed, if his ego strength is so low that he cannot tolerate the anxiety involved in direct work with his stuttering, he will reveal this and at the same time define his own need for psychotherapeutic support and help.

The Sequence of Treatment

Treatment follows in broad outline the five levels of approach-avoidance conflict in stuttering. The speech therapy portion of treatment is emphasized first, with supportive and abreactive psychotherapy next, and finally deeper psychotherapy should this become necessary.

The treatment proceeds through an integration of psychotherapy and speech therapy. The speech therapy portion of the treatment is aimed at supporting the stutterer in strengthening approach reactions to feared words and feared situations. Doing this may include working directly with the stuttering behavior itself.

In the sequence of treatment, then, we offer the stutterer speech therapy first, focusing if he wishes around his feelings as a stutterer and his attempts to handle word and situation fears. Though certain psychoanalysts might object to this, to the author speech therapy seems a completely logical first step. Since we may readily put at the stutterer's disposal many tools for helping him adjust more comfortably to his handicap, reduce the struggle with which he meets each block, lessen some of the fear, shame and guilt over stuttering, why withhold them? Otherwise, we let the stutterer struggle helplessly for an indefinite period while searching for buried complexes. Moreover, giving the stutterer speech therapy first provides a clinical test as to whether the stuttering is being maintained for present needs. Speech therapy of the non-avoidance type gives the stutterer an opportunity, for the first time, of breaking out of the vicious circle. The manner in which he responds to this opportunity provides a measure of his resistance, an index of his present need for stuttering (*15*, *16*), and an important starting point for deeper psychotherapy.

Many well-meaning clinicians with little knowledge of speech disorders are likely to view all speech therapy as symptomatic. A truly symptomatic approach, however, would confine itself to the elimination and prevention of the occurrence of the symptom, without dealing with the conflicts, feelings and attitudes underlying the symptom. Van Riper's approach to speech therapy, as well as that of Johnson, certainly encompasses far more than mere symptom treatment.

The stutterer who is able to receive what speech therapy offers undergoes a profound psychotherapeutic experience. In many cases the changes in feelings, attitudes and personality of the stutterers may far surpass those in overt speech characteristics. Some stutterers show virtually no overt symptoms, yet suffer greatly from anxieties in anticipation of stuttering that never quite arrives. That such people are helped spotlights the basically psychotherapeutic character of speech therapy.

At the beginning of the therapy, the stutterer is caught in a vicious circle. Though it has been frequently stated that all the stutterer really needs is drive and motivation to overcome his handicap, this is scarcely true of the average naive stutterer. He is likely to extend his efforts toward avoidance, concealment and prevention of the

symptom, all of which merely intensify the approach-avoidance conflict in stuttering. The fear-motivated drive to avoid is strengthened rather than the drive to communicate. When the stutterer is merely told he can conquer his problem if he really wants to, this has the effect of increasing the penalty on the stuttering, therefore, fear, conflict and number of blocks increase.

By offering speech therapy first in treatment, the stutterer is given an opportunity to break out of the vicious circle. When he does not respond to this opportunity, or when he does respond and improves so much that he must sabotage his own improvement through a greater resistance, he provides a focal point for the analysis and understanding of what the stuttering means in his life. It may indeed be, as Dunlap (*2*) and Van Riper (*17*) have held, that many cases of adult stuttering are on a self-maintaining or functionally autonomous basis, so that the original causes no longer operate. Theoretically, those whose stuttering is on a self-maintaining or learning anxiety system basis should clear up with little more than direct speech therapy aimed at reducing fear and avoidance behavior. The first step in therapy for the stutterer, then, should be speech therapy aimed at reducing the stutterer's fears and decreasing his word and situation avoidances.

Feelings, Relationships and Goals

The psychotherapeutic portion of the treatment in stuttering involves releasing and expressing feelings, developing more adequate interpersonal relationships, and freeing the individuals from unadaptive goals. This involves a reduction of approach-avoidance conflicts arising out of the emotionality of the utterance, the nature of the relationship, and the protective or ego defensive functions of the symptom.

An important goal in any psychotherapy is *release of feeling*. Most stutterers have touchy subjects or conflict areas which produce more than the usual amount of blocking. Submerged feelings and other repressed materials responsible for producing blockage in speech require expression and adequate outlet. Such goals are common in psychotherapy, and numerous techniques to achieve them are familiar terms in the literature: release of feeling, clarification of feeling, catharsis, abreaction, working through, play therapy, psychotherapy, and the like. It is interesting that one of the few modern therapists reporting fair success with stutterers is Levy (*11*), whose 'release therapy' is aimed primarily at the expression of feeling. The outward expression of the stutterer's conflict through his speech may be advantageous in pointing out the main problem areas in the expression of feeling.

Many of the assignments and techniques commonly used in therapy with the stutterers may be viewed as systematic exercises in the expression of aggression. Some stutterers may feel quite guilty at first about deliberate stuttering because such behavior seems to imply to them aggression toward the audience. The stutterer who changes his mind about 'faking' to a clerk because 'he seems to be a nice guy, I couldn't do it to him' may illustrate this attitude. Other stutterers commonly appear to get great relief and gratification out of deliberate stuttering. They take it up with great enthusiasm, vying with each other in the collection of 'tough audience' responses. A 'spluttering' or choking up of speech, behavior which superficially resembles stuttering, is a cultural caricature for inexpressible aggression. If stuttering may be viewed this way, in

accord with Fenichel (*5*) and Abbott (*1*), then such techniques as negative practice and 'bouncing' may provide an avenue for the expression of hostile feelings.

In the expression of hostility, stuttering may be viewed as serving a dual role: (1) direct expression of hostile feeling through imposing punishment on the audience; (2) expiation of the guilt arising out of the aggression against the audience through imposing punishment on the stutterer himself. At the same time the active audience penalties frustrate the stutterer, who now feels increased resentment at the person who frustrated his communication and made him feel guilty. Another vicious spiral is involved. The act of stuttering itself seems capable of satisfying these needs, or satisfying the fear. Through speech therapy the therapist assumes the guilt, reduces the stutterer's need to punish himself, and gives the stutterer an opportunity to break out of the vicious circle.

Since interpersonal relations, and the respective roles of speaker and listener so strikingly affect stuttering behavior, the working through by the stutterer of feelings and conflicts revolving around certain crucial relationships becomes essential to success. Fletcher (*6*) showed some awareness of this in his view of stuttering as a social morbidity, indicative of the stutterer's attitude toward all society. Recognition on the part of speech pathologists of the stutterer's need for better relationships has undoubtedly done much to stimulate the development of group therapy methods with stutterers.

The Fear of Fluency

Finally, the ego-protective functions of the symptom and its secondary gains must be dealt with psychotherapeutically. At some point in the treatment of the stutterer, it is necessary to consider the effect of the handicap, and especially the effect of recovery from it, upon what the individual has planned to do with his life. Open-ended questions or partially structured sentence completion items may be especially revealing: 'If your stuttering suddenly disappeared, what difference would it make in your life?' or 'If I could get over stuttering, I would. . . ."

Frequently, such questions make the stutterer anxious. Because the defect may become a peg upon which to hang all his shortcomings, or perhaps because of the capacity of the human organism to adapt itself to the disturbance, the stutterer is likely to feel a little strange about his symptom. He may have lived with his stuttering so long that functioning without it involves too radical a change in self-concept to be readily assimilated.

In the acquisition of his speech disorder the stutterer often develops a fear of silence; in the course of treatment he frequently reveals a fear of fluency. Sudden fluent speech may provide a substantial psychological shock for the stutterer, and the therapist should always be on guard that the stutterer is prepared for the loss of the primary and secondary gains. The closing stages of therapy must always involve a careful preparation for recovery.

Just as in the early stages of treatment, the stutterer needs to accept himself as a stutterer, so in the final stages he must learn to accept himself as a normal speaker. The second adjustment is sometimes bigger than the first.

In accepting normality, the stutterer not only gives up the secondary gains which have helped to maintain the disorder, but acquires a radically differ-

ent self-concept. Gone are his rationalizations of the tremendous strides he could make if the stuttering did not hold him back. The attainment of fluency inevitably brings the stutterer many disappointments. He discovers that he is not a giant in chains; he is just an ordinary mortal with ordinary weaknesses. The countless disappointments of not getting his wish are now eclipsed. Like Shaw, the stutterer finds there are two ways to be disappointed in life. One way is not to get what we wish for. The other way is to get it.

Preparation for Recovery

Although many stutterers are initially resistant to speech therapy, the really substantial resistance is likely to come following a certain amount of recovery. When the stutterer makes enough progress so that he is threatened with the loss of secondary gains, his resistances are likely to assert themselves. Many relapses occur when the stutterer attains fluency too suddenly before he is prepared to relinquish the secondary gains.

Relapses are not necessarily to be avoided in the treatment of the stutterer, but may be utilized in these ways: (1) As a means of helping the stutterer understand his resistance, and the ego-protective functions of the disorder; (2) to teach the stutterer that relapse is not catastrophic, and that he can learn to come out of it by the same methods he has used to conquer the problem initially.

Finally, it is advisable to maintain therapy for some time following the attainment of fluency, and to plan therapy with this assumption. Partly, this continuation is important because of the learned behavior aspect of the stuttering pattern itself; some 'overlearning' of the new response pattern is desirable. Partly, continuation is necessary because of the pervasive effects of recovery from lifelong stuttering upon the individual and his conception of himself.

An essential part of the removal of the ego-protective sources of reinforcement of the stuttering should be a careful psychotherapeutic exploration of the adaptiveness of the stutterer's goals, and the relation of these to the disorder. If the stutterer has enslaved himself to a striving toward unattainables, the therapist should help him find freedom. If the stutterer's level of aspiration is lower than the capabilities warrant, the therapist may help him realize the new possibilities opening up before him.

In summary, from the theory of stuttering as an approach-avoidance conflict, speech therapy and psychotherapy are not in competition with each other, but have a common goal—the reduction of all tendencies to avoidance and of the fears which motivate them. Therapy is carried out successively at each of the levels at which approach-avoidance conflict occurs at stuttering—word and situation, feeling, relationship, and ego-protective. Psychotherapy and speech therapy then become twin avenues to the common goal of reducing the fear, avoidance and 'holding back' responsible for the stutterer's conflict.

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The Effect Of Changes In Side-Tone Delay And Level Upon Rate Of Oral Reading Of Normal Speakers

Robert W. Peters

IN THE communicative process of oral speech there are essentially two transmission channels; one leads to the receiver or destination of the message, the other to the originating source of the signal. The operation of the latter channel is designated by the term auditory side-tone. This side-tone signal provides the speaker with information relative to his continuous oral speech performance. In accordance with the concept of cybernetics (*8*), changes in oral speech may be predicted to occur as the side-tone channel is altered.

Changes in the transmission time and sound pressure level of side-tone have been found to affect oral speech. Black (*2*) found that rate of oral reading was progressively retarded as speakers read under increasing increments of side-tone delay within the ranges of 0.03 to 0.18 second and that sound pressure level of response was progressively increased as speakers read under delay times of 0.03 to 0.30 second. Lee (*4*) described the speech of individuals speaking under the condition of delayed side-tone as becoming characteristically halting and repetitive. Studies involving the experimental altering of the sound pressure level of the side-tone signal have indicated that the individual responds to an increased side-tone level by lowering his vocal sound pressure level and responds to a decreased side-tone level by raising his vocal level (*3*, *5*).

During the process of oral speech, several side-tone pathways are operative. Two major pathways are: (a) by air conduction, following the shortest route from the vocal folds past the lips to the ear, and (b) by bone conduction, directly to the cochlea from the vocal folds through the medium of bone and tissue. Stromsta (*6*) has estimated the minimum propagation time for bone-conducted side-tone to be 0.0003 second and for air-conducted side-tone to be 0.001 second.

The consideration of the possibility that these normal side-tone delays may constitute a retarding influence upon the rate of oral speech, as does abnormal delay when introduced into the side-tone channel, led to an experiment in which the effects of accelerated side-tone transmission times at four sound pressure levels upon the rate of oral reading were investigated.

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Procedure

To achieve the experimental conditions of the study, an electronic circuit and an air-link delay unit[1] replaced the normal external side-tone channel. Sound attenuation units, that were fitted closely over the experimental subject's ears, attenuated the external side-tone signal and served to match the impedance of the ear canal in that no apparent rise in bone-conducted side-tone occurred with these devices in position over the ears (*1*). A bone-conduction transducer, attached at the throat externally to the larynx, through associated amplifiers fed the side-tone signal to the delay system. The delayed signal was delivered back to the subject's ears through a pair of insert type magnetic receivers mounted in the sound attenuation units adjacent to the entrances to the ear canal. The air-link delay system was employed to provide two amounts of side-tone delay, 0.0003 and 0.001 second delay. A third delay time, 0.00015 second, was obtained through by-passing the air-link delay unit. Through control of an attenuator, the side-tone signal was delivered to the speaker's ear at four sound pressure levels. These levels were the normal side-tone sound pressure level at the ear (0.96 dynes per square centimeter with voice level at the required experimental level), five decibels below and five and ten decibels above the normal level at the ear.

Eighteen college age males with normal hearing served as experimental subjects. Each subject read a total of 36 five-syllable phrases (7) and a short prose passage under each of the 12 experimental conditions. The initial 15 phrases and the last five phrases constituted practice reading material under the condition. Two sets of eight five-syllable phrases folowing the initial 15 phrases and the passage following the last five phrases comprised the test material read under the condition. Duration in seconds of the reading time for the sets of phrases and for the passage was used as the measure of the subject's reading rate under the side-tone conditions. There were 24 sets of five-syllable phrases, two sets for each experimental condition. The phrases were equated by set for mean duration reading time and mean relative sound pressure level of response. The time intervals between experimental conditions, between practice and test phrases, between practice phrases and the passage and between the onset of successive phrases were kept constant. These intervals were 30 seconds, 10 seconds, 5 seconds and 2.8 seconds, respectively. The signal to begin reading each unit of material was communicated to the subject by the flashing of a light. The subject monitored his voice level visually with a VU meter fed by the throat transducer system. The required voice level to maintain proper deflection on the VU meter was 78 decibels as measured by a sound level meter (the sound level meter placed six inches from the lips, C scale, fast meter reading).[2] The order of presentation of the 12 experimental conditions and the sets of stim-

[1]The delay unit consisted of a sound treated and isolated cylindrical chamber approximately six feet in length and 10 inches in diameter. The desired delay times were obtained by varying the distance between a loudspeaker mounted at the base of the chamber and a mobile microphone suspended in the chamber.

[2]This represents a mean vocal sound pressure level of 12 prestudy subjects reading the five-syllable phrases and the passage at their natural level. Levels on the sound level meter and on a VU meter in the throat transducer system were obtained from the vocal readings and the mean values were determined.

ulus materials was randomized to minimize order and practice effects.

The subjects read the stimulus and practice material under the 12 side-tone conditions at their natural and maximum oral reading rates, each constituting a separate experiment. The reading at natural rates preceded the reading at maximum rates by at least a week and not more than two weeks. For a particular subject, the order of presentation of the stimulus material and experimental conditions remained the same for the two experimental sessions.

The oral speech of the subjects was recorded as they read the two sets of eight five-syllable phrases and the passage under each of the side-tone conditions.

At a later time the recorder-reproducer was coupled to a power level recorder (Sound Apparatus Company, 50 db potentiometer, 50 mm/sec.) and graphic tracings of the recorded speech were obtained. Duration in seconds and relative sound pressure level in decibels for the vocal responses were determined from these graphic tracings. The measurements of duration were averaged for each set of eight five-syllable phrases and for each discrete unit of the passage, the mean becoming the basic score used in the statistical analysis of the data. The measurements of relative sound pressure level were likewise averaged, the mean becoming the basic score used in the analyses pertaining to the sound pressure level of vocal responses.

The data were treated by triple-classification analysis of variance. Analyses were performed relative to each set of stimulus material: Set one, the initial set of five-syllable phrases, set two, the second set of five-syllable phrases and set three, the prose passage.

Results

Considering the test of the hypothesis of no difference in reading rate of speakers reading at their natural rates under three conditions of side-tone delay (0.00015, 0.0003, and 0.001 second) and four conditions of side-tone sound pressure level, the variance attributable to delay conditions was significant at the one per cent level of confidence or better for the first set of five-syllable phrases and the prose passage (Table 1). The variance attributable to delay conditions was non-significant for the second set of five-syllable phrases.

For the 12 side-tone conditions which gave comparisons of duration of vocal responses under three delay times at four sound pressure levels, all show numerically greater mean durations in the progression from the shortest to the greatest delay times when the stimulus material was the passage (Table 2). The same results were found for the mean duration values for the first set of five-syllable phrases with two exceptions, the mean durations were the same for the delay conditions of 0.00015 and 0.0003 second at the sound pressure levels of five decibels below and five decibels above the normal side-tone sound pressure level (Table 2). For the stimulus material of the passage, the mean durations were less at the five per cent level of confidence or better under the conditions of 0.00015 second delay in three instances out of four, than the mean duration under the conditions of 0.001 second delay. For the stimulus material, the initial set of five-syllable phrases, only at the sound pressure level of 10 decibels above the normal level, were the mean durations times significantly shorter under the conditions of 0.00015 and 0.0003 sec-

TABLE 1. Summary of three analyses of variance: Measurements of duration in seconds of vocal responses of subjects reading at natural rates under 12 conditions of side-tone delay and sound pressure level.

Source of Variation	*df*	*Sum of Squares*	*Variance*	*F*†
First Set of Five-Syllable Phrases				
Delay Conditions (D)	2	0.04732	0.02366	10.37**
Level Conditions (L)	3	0.08996	0.02999	9.17**
Subjects (S)	17	1.86601	0.10977	22.60**
D × L	6	0.01006	0.00168	0.35
D × S	34	0.07765	0.00228	0.47
L × S	51	0.16663	0.00327	0.67
D × L × S	102	0.49537	0.00487	
Total	215	2.75300		
Second Set of Five-Syllable Phrases				
Delay Conditions (D)	2	0.01586	0.00793	2.03
Level Conditions (L)	3	0.03668	0.01223	3.44*
Subjects (S)	17	1.78646	0.10509	24.22**
D × L	6	0.00904	0.00151	0.35
D × S	34	0.11181	0.00329	0.76
L × S	51	0.18139	0.00356	0.82
D × L × S	102	0.44236	0.00434	
Total	215	2.58380		
The Passage				
Delay Conditions (D)	2	13.55140	6.7757	10.86**
Level Conditions (L)	3	8.22240	2.7408	5.72**
Subjects (S)	17	597.53580	35.1492	63.22**
D × L	6	2.86670	0.4778	0.86
D × S	34	21.21220	0.6239	1.12
L × S	51	24.43317	0.4791	0.86
D × L × S	102	56.71063	0.5560	
Total	215	724.53230		

*Significant (*F*) at the 5% level.

**Significant (*F*) at the 1% level.

†Error term for *F*-test of Delay Conditions, D × S variance; for Level Conditions, L × S variance.

ond delay than under the delay of 0.001 second (Table 2).

For all three sets of stimulus material, the mean reading rates of the subjects were affected by the sound pressure level of side-tone as was indicated by the significant variance that accompanied side-tone level conditions in the analysis for each set of stimulus material (Table 1). As the level of side-tone sound pressure increased, the mean duration times of the responses tended to increase. Of the significant differences attributable to level conditions, which were found between the mean duration times for the 12 conditions, the majority occurred between the mean durations for the level 10 decibels above the normal side-tone level and the mean durations for the condition five decibels below the normal level (Table 2). A greater num-

ber of significant differences between the mean duration times for the four sound pressure levels occurred at the delay condition of 0.001 second than at the other two delay times. For the shortest two experimental times of side-tone delay, with the stimulus material of the second set of five-syllable phrases and the passage, no significant differences were found between the mean duration values for the four side-tone sound pressure levels (Table 2).

Parallel analyses were performed treating relative sound pressure level scores obtained under the 12 side-tone conditions testing the hypothesis of no difference in sound pressure level of response of the speakers under the experimental conditions. For the three sets of stimulus material, the variance attributable to delay conditions was not significant (Table 3). An inspection of the means indicates that there was a slight tendency for mean sound pressure levels of response to increase as the delay times were increased (Table 4). The sound pressure level of response was significantly affected, however, by the sound pressure level of the side-tone. For the third set of stimulus material the variance attributable to level conditions was significant (Table 3). The mean sound pressure level of the vocal responses tended to increase as the sound pressure level of side-tone was decreased.

The results of the analyses pertaining to data obtained with speakers reading at their maximum rates were similar to the results found with speakers reading at normal rates although the variance for side-tone delay conditions did not reach significant confi-

TABLE 2. Mean duration in seconds of vocal responses of subjects reading at natural rates under twelve conditions of side-tone delay and sound pressure level.

Side-Tone Sound Pressure Level	*Delay in Seconds*		
	0.00015	*0.0003*	*0.001*
First Set of Five-Syllable Phrases*			
10 decibels above normal	1.19	1.20	1.24
5 decibels above normal	1.17	1.17	1.20
Normal level at the ear	1.15	1.17	1.18
5 decibels below normal	1.15	1.15	1.17
Second Set of Five-Syllable Phrases*			
10 decibels above normal	1.18	1.20	1.21
5 decibels above normal	1.17	1.18	1.18
Normal level at the ear	1.15	1.18	1.16
5 decibels below normal	1.16	1.17	1.17
The Passage†			
10 decibels above normal	19.68	20.12	20.38
5 decibels above normal	19.32	19.38	20.12
Normal level at the ear	19.31	19.79	19.87
5 decibels below normal	19.39	19.56	19.77

*Any difference between two means, columns or rows, significant (t), 1%, 0.05; 5%, 0.04 (for second set, rows only).

†Any difference between two means, columns or rows, significant (t), 1%, 0.63; 5%, 0.48.

TABLE 3. Summary of three analyses of variance: Measurements of sound pressure level in decibels of vocal responses of subjects reading at natural rates under 12 conditions of side-tone delay and sound pressure level.

Source of Variation	*df*	*Sum of Squares*	*Variance*	*F*†
First Set of Five-Syllable Phrases				
Delay Conditions (D)	2	10.9631	5.4816	1.45
Level Conditions (L)	3	21.6308	7.2103	2.28
Subjects (S)	17	2399.2289	141.1311	41.96**
D × L	6	22.9420	3.8237	1.14
D × S	34	128.6375	3.7835	1.13
L × S	51	161.2585	3.1619	0.94
D × L × S	102	343.0428	3.3632	
Total	215	3087.7036		
Second Set of Five-Syllable Phrases				
Delay Conditions (D)	2	11.1525	5.5763	1.33
Level Conditions (L)	3	25.8818	8.6273	2.31
Subjects (S)	17	2364.3607	139.0800	52.94**
D × L	6	3.2530	0.8755	0.33
D × S	34	142.0808	4.1788	1.59
L × S	51	190.0775	3.7407	1.42
D × L × S	102	267.9829	2.6273	
Total	215	3006.7892		
The Passage				
Delay Conditions (D)	2	4.0886	2.0443	0.78
Level Conditions (L)	3	22.6638	7.5546	4.14*
Subjects (S)	17	2097.2895	123.3700	52.27**
D × L	6	9.7205	1.6201	0.69
D × S	34	88.9830	2.6171	1.11
L × S	51	93.1382	1.8262	0.77
D × L × S	102	240.7588	2.3604	
Total	215	2556.6424		

*Significant (*F*) at the 5% level.
**Significant (*F*) at the 1% level.
†Error term for *F*-test of Delay Conditions, D × S variance; for Level Conditions, L × S variance.

dence limits for any of the three sets of stimulus material. The variance attributable to side-tone sound pressure level conditions did reach significant limits. Duration of speech was longer as the sound pressure level of side-tone was increased.

Discussion

The results found in this study seem to be in accord with the theory of cybernetics that the altering of the feedback circuit produces changes in the performance of the organism. With speakers reading at their natural rates an accelerated side-tone delay transmission time resulted in a faster rate of speech, and with increased sound pressure levels of side-tone rate of speech was retarded. The two did not seem to be independent, for where significant differences in vocal dura-

TABLE 4. Mean relative sound pressure in decibels of vocal responses of subjects reading at natural rates under twelve conditions of side-tone delay and sound pressure level.

Side-Tone Sound Pressure Level	*Delay in Seconds* 0.00015	0.0003	0.001
First Set of Five-Syllable Phrases			
10 decibels above normal	24.86	25.77	25.48
5 decibels above normal	25.93	25.94	26.54
Normal level at the ear	25.48	25.23	26.27
5 decibels below normal	26.01	26.63	26.21
Second Set of Five-Syllable Phrases			
10 decibels above normal	24.92	25.57	25.20
5 decibels above normal	25.85	26.12	26.26
Normal level at the ear	25.31	25.39	26.01
5 decibels below normal	25.56	26.21	26.30
The Passage*			
10 decibels above normal	25.69	26.55	26.29
5 decibels above normal	26.64	27.22	26.66
Normal level at the ear	26.72	26.56	26.64
5 decibels below normal	26.81	27.21	27.12

*Any difference between two means, columns only, significant (t), 1%, 1.28; 5%, 0.98.

tion means were found, the differences occurred at the sound pressure levels of normal side-tone pressure level or above. Considering the similar magnitude of bone-conducted and air-conducted side-tone this finding was to be expected. It is possible that at the lower sound pressure levels of external side-tone the individual was experiencing sufficient magnitudes of bone-conducted side-tone to minimize the effect of transmission changes in external side-tone.

The finding of a reduced effect of side-tone delay and level changes upon the rate of reading for a second as compared to a first set of similar stimulus material read under each condition, suggests that the speaker, reading at his natural rate, may adapt to both delay and level of side-tone in his rate of oral speech.

There appears to be a tendency for the speaker to maintain a constant sound pressure level of side-tone at the ear. The sound pressure level of vocal response is raised as the level at the ear is decreased and is lowered as the pressure level at the ear is increased.

Summary

This article is concerned with the effect of accelerated side-tone transmission times upon rate of oral reading. The results would seem to indicate: (a) that speakers, under instruction to read naturally, read at faster reading rates under conditions of accelerated side-tone delay than they do under the condition of side-tone delay which approximates the transmission time of normal side-tone; and (b) that speakers, under instruction to read naturally, read at a progressively faster reading rate as the sound pressure level of side-tone is decreased.

Similar results of retarded rate of speech with increased side-tone delay time and increased side-tone sound

pressure level were noted with the speakers reading at their maximum rates.

To the extent that the experimental conditions duplicated the normal side-tone experience, the normal external side-tone transmission time may be said to constitute a retarding influence upon the rate of oral speech.

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Relationships Between Certain Aspects Of Personality And Some Vocal Effects Of Delayed Speech Feedback

Bernard Spilka

A SURVEY OF the literature on psychological stress reveals a surprising lack of research on one of man's most apparent and evident modes of adjustment, namely vocalization as expressed through speech content and voice qualities. The literature on emotion, stress, and vocal response is voluminous and may be traced without much difficulty as far back as Plato. Despite this rather extensive theorizing and writing, an exhaustive survey of the research literature on stress and vocalization has revealed only a few research studies which appear to be concerned with stress and vocalization. In one of these investigations which was conducted in 1934, Waggener (*26*) found that speakers rated as inferior revealed more psychogalvanic response disturbance than speakers rated good, when talking before an audience. Performing before an audience has often been regarded as stress producing. A direct study of speech and voice under stress conditions was reported by Baker and Harris (*1*) in 1948. They found that a stress condition of mild electric shock to speakers communicating over high level noise tended to reduce speech intelligibility, shorten syllable duration, and increase vocal intensity variation. Utilizing a sample of 14 subjects they obtained evidence which indicated that certain personality characteristics were related to the observed vocal changes.

The present study represents an attempt to further such investigation by observing some vocal accompaniment of stress when the focus of the stress is apparently on the speaking process itself. In addition, an attempt was made to predict on theoretical grounds the direction of any relationships which might obtain between the classes of variables.

The technique used here to induce stress upon the vocal process has been variously termed delayed speech, sidetone, or auditory feedback, and basically consists of transmitting an individual's speech side-tone back to his ears at a time delay usually from .03 to .40 second instead of the .001 second delay that normally occurs. The vocal effects of such a delay in audi-

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tory feedback appear as speech sound repetitions, prolongations, blocks, and measurable changes in pitch and loudness. Cutler (*8*), in a recent study concerning stress effects on time perception, successfully employed delayed feedback as a means of producing stress. From Cutler's observations of subjects, it would appear that this technique produces a rather severe stress situation in the sense that the subject suddenly finds that one aspect of his behavior, previously under almost complete control, now can be controlled only within gross limits at the expense of considerable effort.

When a person is subjected to a delayed speech feedback condition and instructed to speak in his normal manner, he may vary in his ability to control his speech all the way from complete maintenance of his everyday pattern to a total inability to make more than incoherent sounds. It was believed that this great variation might be partially accounted for by personality factors. To test this position the following rationalia and hypotheses were developed.

One of the most frequently cited explanations by subjects capable of withstanding the influences of delayed feedback is that one must be able to avoid being influenced by the auditory stimuli and at the same time concentrate on or 'feel' his speech. These subjects believe they maintain normal speech patterns by kinesthetic rather than auditory speech cues. In developing an explanation for the apparently great individual variation in ability to attend to kinesthetic speech cues, the position is taken that all adjustment is, in part, a function of a balance between attention to external and internal cues and the ability to vary such attention as conditions change. In other words, a person must attend to a certain degree to both external and internal cues to effect optimal adjustment. For example a schizoid, autistic type of adjustment may result from a chronic overemphasis on internally produced cues whereas hypomanic extroversion may be an extreme expression of abnormal responsiveness to external cues. It is thus hypothesized that the manner and degrees in which speech and voice are altered by delayed sidetone are a function of (1) emphasis on either exteroceptive (auditory) cues or the proprioceptive (kinesthetic) cues of speech, and (2) the ability to shift from one set of these cues to the other. An examination of the literature on personality brought to light a number of individual characteristics, apparently closely related to the hypothesized optimal balance and flexibility of attention, and hence to the vocal effects of delayed speech feedback. These traits, which were chosen for study, have been termed (1) self-percept stability, (2) schizoid tendencies, (3) paranoid tendencies, and (4) rigidity.

Self-percept Stability. According to the theoretical formulations of Lecky (*16*), Raimy (*20*), and others (*13*, *15*), there is implicit in all behavior an evaluation or concept of the self. To Raimy (*20*), this principle is that 'the self concept is the map which each person consults in order to understand himself during moments of crisis or choice.'

Research on self percepts (*2*, *5*, *19*) has shown that negative self attitudes are associated with similarly undesirable views of the world and a general neurotic type of adjustment. Stagner (*23*) and others (*4*, *12*) have demonstrated that such maladjustment and negative self percepts are often related to an apparent instability of

the individual's self conceptual system which is manifested by relatively great variability in one's self views.

The hypothesis is advanced here that this variability of reaction is a function of sensitivity to environmental changes, and that the individual reacts in an apparently unstable manner in order to cope with the changes he perceives in his surroundings. Highly accentuated exteroception is thus one form of defense for an unstable and inadequately functioning self-conceptual system. With respect to vocal responses to delayed auditory feedback, it is hypothesized that such an individual will attend compulsively to the incoming (exteroceptive) auditory signals to the detriment of attendance to kinesthetic speech cues and thus will demonstrate considerable vocal change. In other words, degree of vocal change under delayed feedback is negatively related to the level of self and social adjustment.

Schizoid Trends. In the preceding section, discussion was mainly concerned with personality characteristics, which it is hypothesized, relate positively to the amount of vocal change occurring under conditions of delayed speech feedback. The opposite situation is hypothesized in the case of those characteristics labeled as *schizoid*. The traits of schizoid individuals have been variously listed as unsocialibity, introversion, autism, etc. One schizoid trait which Kreschmer (*14*) and others (*6*, *10*, *17*) have emphasized is the ability of schizoid persons 'to concentrate more on certain characteristics of the stimulus to the neglect of all others.' The defenses of such a person appear to be organized in such a manner that stress conditions might serve to increase the tendencies to encapsulate. This, combined with the tendency to respond to internally produced cues in preference to those from the outside world, suggests that these persons, when subjected to delayed feedback, may be able to concentrate on the speech disturbing influences of the delayed side-tone condition. In other words, a negative relationship is hypothesized between the presence of schizoid characteristics and the degree of vocal change occurring under a delayed feedback condition. Since constriction and withdrawal are often noted as schizoid traits, it may also be hypothesized that such methods of reaction may result in such responses to delayed feedback as a reduction in vocal intensity or the development of monotonous vocal characteristics.

Paranoid Trends. Discussions of paranoid characteristics (*6*) emphasize the importance of projection in maintaining the paranoid delusional system. Associated with this tendency to externalize one's difficulties appears to be an over-emphasis on environmental changes as real or imagined threat from the outside becomes imminent. A study by Wright (*27*) suggests that stress will tend to increase such projective and externalizing tendencies. In the present frame of reference, the theoretical position is advanced that under the stress conditions of delayed feedback certain individuals, to the extent that they utilize paranoid defenses, will be unable to attend to the kinesthetic cues of speech. This will occur because of an increase in the tendency to focus on external influences. It is thus hypothesized that positive relationships will obtain between the degree of vocal change manifested under the

delayed feedback condition and the prevalence of paranoid modes of thought and behavior.

Rigidity. The available research on personality rigidity indicates that persons subjected to stress conditions will, to the extent that their usual behavioral reactions are rigid and maladaptive, reveal a 'looseness and breakdown' in their defenses (*9*). Beier (*3*) also found evidence that anxiety appears to effect a disorganization in the perceptual field. What these and other researchers suggest is that the rigid person may find his rigidity maladaptive in a stressful situation. As his defenses prove inadequate his behavior becomes somewhat chaotic. To the degree that delayed speech feedback is stress producing, to the extent that an individual possesses rigid modes of defense, it is hypothesized that his vocal behavior will be changed. In other words, his vocal responses will reveal 'looseness and breakdown,' will deteriorate and his speech will be severely affected by the delayed speech feedback condition.

Experimental Procedure

Subjects. The subjects employed in this investigation were 150 male students, ranging in age from 18 to 27 years. All were from a basic speech course at Purdue University.

Instrumentation. The instruments which were used for recording and measuring the speech samples studied in this investigation were: (1) A Magnecord Corporation high fidelity magnetic tape recorder with type PT6-AH recording unit and type PT6-J amplifier. This instrument was modified so that it could be employed for delayed feedback research. The complete unit is known as the Magne-

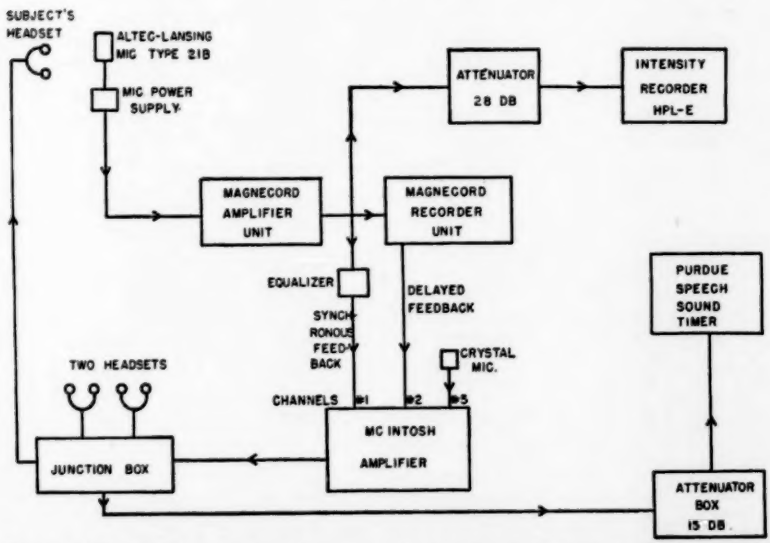

FIGURE 1. Block diagrams of synchronous and delayed speech feedback circuits and instrumentation for voice variable measurements.

corder. (2) A McIntosh Engineering Laboratory amplifier type 20W-2 and McIntosh amplifier equalizer unit type AE-2A. (3) An Altec Lansing Corporation M11 microphone system with Altec 21B miniature condenser microphone. (4) Two Hewlett-Packard Corporation 110 decibel step attenuators, model 350A. (5) A Sound Apparatus Company High Speed Power Level Recorder, Model HPL-E. (6) Purdue Speech Sound Timer. (7) Three headsets, type ANB-H-1. (8) One Astatic Corporation crystal microphone, type JT-30. A block diagram of the circuit containing the above instruments may be seen in Figure 1.

The operation of the circuit may be described as follows: The speech signal was transmitted by the Altec Lansing microphone system to the input of the Magnecord amplifier unit. All signals for which synchronous feed-back was intended were transmitted to the subject's earphones through an equalizer and channel 1 of the McIntosh amplifier. The equalizer served to equate the frequency response characteristics of the synchronous and delayed speech feedback channels. Signals which were transmitted to the subjects under delayed feedback conditions were coupled first from the Magnecord amplifier unit into the Magnecord recorder section which produced the side-tone delay, and the resulting delayed signal reached the subject by means of channel 2 of the McIntosh amplifier. Measurements of certain attributes of each subject's speech were obtained simultaneously on the Purdue Speech Sound Timer (a device from which certain rate-duration data may be obtained) and the model HPL-E power level recorder. Hewlett-Packard attenuators were placed in the circuits of these two instruments so that the speech signal voltages could be adjusted to obtain optimal recording performance.

In order to mask air and bone conduction auditory cues for simultaneous speech under the delayed side-tone condition, and to effect as much change as possible in the speech of subjects, it was believed desirable to transmit a subject's speech back to him at a greatly increased intensity level (*6*). Empirically a level was decided upon which appeared to be near the threshold for discomfort, but was still bearable. Computation revealed that, on the average, side-tone intensity for the 150 subjects was 46.6 db above input vocal intensity, with a standard deviation of 3.1 db. For synchronous feedback this level was 112.23 db, and for the delayed side-tone condition it was raised to 119.76 db.

It was mentioned earlier that the Magnecorder was modified so that it might be employed in delayed side-tone research. The chief modification consisted of the addition of a playback head to the recording unit. The erase, record, and new playback heads of the recorder were arranged so that a 42-inch loop of recording tape would travel first over the erase head, which removed all previously recorded signals. The tape then passed over the recording head. The playback head then picked up these recorded signals which were transmitted back to the talker. The playback head was mounted so that it could be moved in a line, from .93 to 6.10 inches from the record head. The distance between the playback and record heads and the tape speed determines time delay between the impressing of a signal by the record head and the feedback of that signal

through the playback head. The panel on which the playback head was mounted was calibrated in steps of .031 second from a delayed feedback time of .062 second to .406 second when the tape speed was 15 inches per second. A delay time of .187 second was used in the present study.

The reading material used consisted of a 73-word phonetically balanced passage.

Method

The subjects were taken individually into the sound-treated laboratory. Each subject was seated at a desk upon which was clamped the Altec 21B microphone, so mounted that it was possible to place the tip of the microphone between three and four inches from the subject's mouth. The subject was instructed to maintain this distance at all times during the testing periods. A pair of ANB-H-1 headphones mounted in a helmet and connected to the feedback channel of the circuit was worn by the subject. Thus the side-tone was received primarily through the headset. The passage to be read was placed on a clipboard situated directly in front of the subject and slightly above the microphone.

Following the initial seating and instruction of the subject, the experimenter directed the experiment from another sound-treated room which contained the feedback and recording equipment. Contact with the subject was maintained by means of a microphone which was connected through channel 5 of the McIntosh amplifier to the headphones. The remaining instructions were communicated to each subject through this system.

During a preliminary reading of the passage, the experimenter manipulated the gain control for the Magnecord amplifier so that the majority of the subject's vocal intensity peaks fell between ± 1 unit on the VU meter. This procedure was designed to achieve a certain consistency of the signals recorded on the sound timer and power level recorder.

Following this first reading of the passage, the subject was instructed to reread it. As the subject completed an introductory phrase to the passage, the experimenter set the power level recorder and the sound timer in operation. When the subject finished reading the complete passage, these instruments were shut off, the dial readings of the timer were recorded, and the tape was removed from the power level recorder. The first two readings of the passage were conducted under conditions of synchronous feedback. A third reading was then conducted under the condition of delayed feedback. Before this reading, the subject was given instructions similar to those of the first two readings, with the addition of a warning that on this trial he might experience some difficulty in reading. The subject was told not to stop reading nor to laugh when experiencing difficulty.

The McIntosh feedback control was set to the delayed feedback channel, and as the subject read, recordings of his vocal rate and intensity again were taken. At the completion of this reading the subject was informed that the testing period was over. He was then requested not to tell future subjects about the experiment and was dismissed. This procedure was followed for all 150 subjects who participated in this study. Following the experimental sessions the subjects were given four personality scales to fill out.

Personality Tests. The psychological examinations which were employed in the present investigation were: (1) the California Test of Personality, Secondary Series; (2) An Inventory of Factors STDCR; (3) The Total Ethnocentrism Scale, Public Opinion Questionnaire E; and (4) The Paranoia and Schizophrenia scales of the Minnesota Multiphasic Personality Inventory.

The California Test of Personality (*25*) was chosen to test the previously formulated hypothesis concerning the adequacy and stability of the self-conceptual system. Designed to measure 12 aspects of personal and social adjustment, this test had been widely employed in investigations of attitudes toward the self (7, *21*).

The Inventory of Factors STDCR was also employed as a test of adjustment and self-percept stability; however, the social and thinking introversion scales of this examination, as Guilford (*11*) suggests, may tap the area of schizoid traits. A similar interpretation may be made of the withdrawing tendencies sub-scale of the California test.

On the basis of various investigations relating ethnocentrism and behavioral rigidity (*10, 22*), the *Total E-scale* was chosen to test the earlier proposed hypothesis regarding rigidity and the vocal response to delayed feedback. In addition to the scoring system suggested by the test authors, a system was devised, based on the belief that individuals with strong convictions, ethnocentric or non-ethnocentric, will tend to be more rigid than those who feel less intensely on this subject. The measures used to evaluate this approach were: (1) the total number of extreme agreements with the ethnocentric items (+ 3's), (2) the number of extreme disagreements (− 3's), and (3) the total number of extreme responses (+ 3's and − 3's).

In order to test the proposed hypotheses concerning paranoid and schizoid personality tendencies, the Paranoia and Schizophrenia sub-tests of the Minnesota Multiphasic Personality Inventory were employed.

Statistical Analysis

The basic data of this study consisted of the scores from the psychological scales and four voice variable measures. These were: (1) average syllable duration, (2) per cent phona-

TABLE 1. Comparison of means for the vocal intensity and vocal rate-duration measures obtained under conditions of synchronous and delayed speech feedback (N=129).

Voice Variable	*Synchronous Feedback*	*Delayed Feedback*	*t-ratio*
Per Cent Phonation Time	49.31	72.62	11.656*
Average Syllable Duration (sec.)	.123	.284	9.081*
Mean Intensity (db above an arbitrary reference)	19.085	28.365	14.948*
Intensity Variance (db)†	7.630	10.535	4.035*

*Significant beyond the .01 level of confidence.

†In order to test for the significance of the differences between the means of intensity variances for two correlated series as above, the original data were transformed to logarithms, and the formula specified by Peters and Van Voorhis (*18*) was applied.

TABLE 2. Coefficients of correlation between voice variable measures and the factors of the California Test of Personality.

California Test of Personality		*Voice Variable Measures**					
Scale	*Factors*	*1*	*2*	*3*	*4*	*5*	*6*
1a	Self-Reliance	.005	−.154†	.018	−.195†	−.282†	.076
1b	Sense of Personal Worth	.062	−.035	−.014	−.036	−.026	−.112
1c	Sense of Personal Freedom	.204†	.074	.192†	.122	.054	.313†
1d	Feeling of Belonging	−.016	.010	−.054	−.054	−.041	−.192
1e	Freedom from Withdrawing Tendencies	.092	.013	.098	−.197†	−.204†	.128
1f	Freedom from Nervous Symptoms	.082	−.029	−.011	−.205‡	−.274‡	.033
	Self Adjustment	.112	.113	.063	.187†	−.235‡	.208†
2a	Social Standards	.006	−.097	.034	−.034	−.011	−.085
2b	Social Skills	−.038	−.087	−.012	−.219‡	−.203†	−.142
2c	Freedom from Anti-Social Tendencies	−.057	−.060	.064	−.126	−.148	.140
2d	Family Relations	.003	.014	−.005	−.038	−.008	−.086
2e	School Relations	−.005	−.037	.033	−.020	−.006	−.155
2f	Community Relations	−.116	−.139	−.026	−.100	−.200†	−.228
	Social Adjustment	−.072	−.099	−.030	−.157†	−.129	−.232
	Total Adjustment	.028	−.066	.024	−.184†	−.196†	−.089

*The voice variable measures are coded as follows: 1, Per cent phonation time; 2, Syllable duration; 3, Mean vocal intensity; 4, Degree of change in vocal intensity variance; 5, Degree of increasing change in vocal intensity variance; 6, Degree of decreasing change in vocal intensity variance.

†Indicates significance at or beyond the .05 level of confidence.

‡Indicates significance at or beyond the .01 level of confidence.

tion time, (3) mean vocal intensity, and (4) vocal intensity variance. These latter scores will be referred to as *difference-scores*, for they consisted of the measures obtained for the synchronous feedback condition subtracted from the corresponding measures obtained under delayed feedback. Thus they indicated the amount of change occurring between the two conditions.

In order to test the proposed hypotheses, Pearson Product-Moment correlations were computed between the psychological examination scores and the difference-scores. Since the hypotheses specified the direction of the relationships to be studied, the employed significance tests (Student's) refer only to one-sided alternatives.

Where further analysis appeared fruitful by combining of various of the psychological measures to predict a voice variable change, the Wherry-Doolittle Test Selection method was employed.

Results and Discussion

For the 150 subjects who were tested, only 129 complete records

TABLE 3. Coefficients of correlation between voice variable measures and the subtests of an inventory of factors STDCR.

Subtests of an Inventory of Factors STDCR	*Voice Variable Measures**					
	1	*2*	*3*	*4*	*5*	*6*
S	.019	.081	.005	.157†	.155	.360†
T	.028	.026	.002	.115	.163	.031
D	−.022	.092	−.021	.212‡	.248	.144
C	.022	.050	.032	.124	.194†	.009
R	.027	−.132	.022	−.096	.088	.032

*The voice variable measures are coded as follows: 1, Per cent phonation time; 2, Syllable duration; 3, Mean vocal intensity; 4, Degree of change in vocal intensity variance; 5, Degree of increasing change in vocal intensity variance; 6, Degree of decreasing change in vocal intensity variance.

†Indicates significance at or beyond the .05 level of confidence.

‡Indicates significance at or beyond the .01 level of confidence.

were obtained, thus the following analyses refer primarily to samples of 129 men each. In dealing with vocal intensity variance, however, two subsamples of 99 and 30 men each were formed. The former number indicates those persons who revealed an increase in vocal intensity variance under delayed feedback, and the latter group those whose vocal intensity variance decreased.

Table 1 presents the group means on the voice variables for the two feedback conditions. In summary, these data reveal that the average subject when speaking under delayed feedback spoke slower, utilized more of his total speaking time in actual phonation, raised his intensity, and became more variable in his use of vocal intensity.

Actually all the subjects without exception revealed an increase in syllable duration, per cent phonation time and mean vocal intensity under the delayed feedback condition. As mentioned above in the case of vocal intensity variance, 99 of the subjects increased their intensity variance while the remaining 30 manifested a decrease. As indicated by the significance tests presented in Table 1, the

TABLE 4. Coefficients of correlation between voice variable measures and schizophrenia scale scores.

	*Voice Variable Measures**					
	1	*2*	*3*	*4*	*5*	*6*
Sc Scale	.018	.053	.065	.135	.131	.306†

*The voice variable measures are coded as follows: 1, Per cent phonation time; 2, Syllable duration; 3, Mean vocal intensity; 4, Degree of change in vocal intensity variance; 5, Degree of increasing change in vocal intensity variance; 6, Degree of decreasing change in vocal intensity variance.

†Indicates significance at the .05 level of confidence.

delayed condition did significantly affect the voice variables under study.

The hypothesis regarding self-percept stability and vocal change achieved support, as 16 correlations which were significant in the predicted direction were obtained between the voice variable scores and the scale scores from the STDCR and California Test of Personality. Four significant relationships were obtained in the non-predicted direction. Since the hypothesis concerning schizoid reactions involves subtests of these examinations, factors S and T of the STDCR and subtest 1e of the California Test, these were not included in testing the hypothesis concerning self-percept stability. The most noticeable tendency revealed by the analysis was for vocal intensity to become more variable as self percepts and social adjustments become poorer, possibly reflecting loss of control over vocal intensity as the self conceptual system becomes more unstable. Tables 2 and 3 summarize the results of this analysis.

In the case of withdrawal and schizoid modes of thought, Tables 1, 2, and 4 reveal that vocal intensity variance tended to decrease as social introversion, withdrawal and schizoid tendencies increased. In other words, the hypothesized constrictive tendencies were manifested by the development of monotonous vocal intensity characteristics.

Utilizing three of the significant relationships (see Table 5), a multiple correlation of .584 was obtained between decreasing vocal intensity variance and factor S of the STDCR, scale 1c of the California test, and the Schizophrenia scale of the MMPI. The hypothesis regarding a negative relationship between schizoid behavior and voice variable change was not supported.

A significant correlation of .252 (see Table 6) was obtained between increasing vocal intensity variance and the Paranoia scale of the MMPI, thus providing support for the earlier stated hypothesis regarding these variables. Of the six correlations computed only those two relating to vocal intensity variance revealed any significance.

The hypothesis regarding the relationship between vocal change and rigidity defenses was rejected, for in-

TABLE 5. Multiple correlation coefficients between vocal intensity variability change and various of the employed personality scales, as computed by the Wherry-Doolittle test selection method.

*Test Factors and Combinations**	*R*
Increasing Vocal Intensity Variation and:	
A	.318
A+B	.402
A+B+C	.460
A+B+C+D	.482
A+B+C+D+E	.489
A+B+C+D+E+F	.491
Decreasing Vocal Intensity Variation and:	
G	.360
G+H	.517
G+H+I	.584

*The test factors code which was employed above is as follows: A, total number of 3's on the E-scale; B, the Paranoia scale of the MMPI; C, the Self-Reliance Scale of the California Test of Personality; D, the Community Relations Scale of the California Test of Personality; E, the Freedom from Nervous Symptoms Scale of the California Test of Personality; F, the number of –3's on the E-scale; G, the Social Introversion Scale of an Inventory of Factors STDCR; H, the Sense of Personal Freedom Scale of the California Test of Personality; I, the Schizophrenia Scale of the MMPI.

TABLE 6. Coefficients of correlation between voice variable measures and paranoia scale scores.

	*Voice Variable Measures**					
	1	*2*	*3*	*4*	*5*	*6*
Pa Scale	−.051	−.078	.017	.193†	.252‡	.080

*The voice variable measures are coded as follows: 1, Per cent phonation time; 2, Syllable duration; 3, Mean vocal intensity; 4, Degree of change in vocal intensity variance; 5, Degree of increasing change in vocal intensity variance; 6, Degree of decreasing change in vocal intensity variance.

†Indicates significance beyond the .05 level of confidence.

‡Indicates significance beyond the .01 level of confidence.

stead of the predicted change in the voice variables studied, for extremists on the E-Scale the finding was in the opposite direction, demonstrating better control of intensity variation under the delayed feedback condition (see Table 7). In other words, rigidity, as defined here, appears to be negatively rather than positively related to vocal change under delayed feedback. It may be that the delay condition does not place enough stress to produce the hypothesized 'looseness and breakdown,' and thus the rigidity defenses were quite adequate for coping with the stress situation.

Of the voice variables studied, only vocal intensity variance demonstrated any consistent relationship with personality. None of the rate-duration measures or mean vocal intensity revealed any noteworthy or consistent relationships with the personality scores.

In addition to a multiple correlation coefficient for predicting decreasing vocal intensity variation, Table 5 presents the results of a similar analysis to predict increasing vocal intensity variation. Utilizing the Wherry-Doolittle procedure the addition of tests was stopped after 6 had been em-

TABLE 7. Coefficients of correlation between voice variable measures and E-scale scores.

E-Scale Scores	*Voice Variable Measures**					
	1	*2*	*3*	*4*	*5*	*6*
Total E-Scale Score	.041	.017	.015	.039	−.085	.053
Number of +3's	−.113	−.143	−.058	−.154†	−.171†	−.054
Number of −3's	−.137	−.059	−.049	−.168†	−.245‡	.103
Total Number of 3's	−.188†	−.129	−.076	−.237†	−.318†	.077

*The voice variable measures are coded as follows: 1, Per cent phonation time; 2, Syllable duration; 3, Mean vocal intensity; 4, Degree of change in vocal intensity variance; 5, Degree of increasing change in vocal intensity variance; 6, Degree of decreasing change in vocal intensity variance.

†Indicates significance at or beyond the .05 level of confidence.

‡Indicates significance at or beyond the .01 level of confidence.

ployed. The resulting coefficient was .491.

It was the intention of the writer to present the foregoing analysis as an initial exploration, since the theoretical approach with respect to personality and the measures employed require considerable refinement. Despite such considerations, it would appear that the results suggest a need for further evaluation of this technique for research and possibly clinical purposes.

Summary and Conclusions

The vocal responses of 150 young college males were studied under conditions of synchronous and delayed speech feedback. The amount and direction of the change occurring in rate-duration and intensity voice variables were related to selected personality variables. Within the limitations inherent in this research, the following conclusions may be offered:

a. Of the voice variables studied, the amount of change occurring in vocal intensity variation due to delayed speech feedback appears to be most closely related to personality functioning.

b. Increases in vocal intensity variation under conditions of delayed speech feedback appear to be positively related to:

1. Inadequacy and instability of the self-conceptual system as indicated by measures which reveal negative self attitudes and poor general personality adjustment.

2. Paranoid behavioral tendencies.

c. Increases in vocal intensity variation under conditions of delayed speech feedback appear to be negatively related to degree of ethnocentric and/or non-ethnocentric beliefs.

d. Decreases in vocal intensity variation under conditions of delayed speech feedback appear to be significantly and positively related to schizoid, socially withdrawing, and isolating, modes of behavioral adjustment.

e. Changes in the investigated voice variables due to delayed speech feedback other than those which occurred in vocal intensity variation cannot be asserted to be reliably associated with any of the measured aspects of personality.

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A Simple Mechanical Adapter For Variable Side-Tone Delay

William R. Tiffany
Clair N. Hanley
Louis C. Sutherland

IN THE PAST three or four years a rapidly growing interest has been evidenced in the phenomena of side-tone delay, or 'delayed feedback.' Atkinson (*1*), Black (*2*), Lee (*4*), Tiffany and Hanley (*6*), and others have described a complex process of speech breakdown under delayed side-tone conditions and have shown the effect to be a function of the intensity of the side-tone and the amount of its delay.

Because of the research interests and practical applications in the area of delayed side-tone phenomena many workers have set about to construct their own 'feedback machines,' usually on the basis of designs published by Marple and Morrill (*5*) or by Fairbanks and Jaeger (*3*), or have been content to use the less than optimum delay times available as part of existing commercial tape recorders.

One commercial tape recorder readily usable as a delay mechanism is the Presto RC 10/24. In its normal operation a delay of .14 second is possible at a 15 inches per second tape speed.[1] This machine has been used in the phonetics laboratories of the University of Washington Speech Department for research in delayed side-tone effects. The recorder has been satisfactory as a 'feedback machine,' particularly in research where high fidelity and continuous recording are desired. It has the obviously serious drawback, however, that the delay times are not capable of adjustment over a wide enough range and in a continuous fashion. Because of this drawback it was desired to attempt the design of a continuously variable feedback mechanism.

It was decided that the desired delay mechanism should, if possible, meet the following design criteria: (1) It should introduce no new electrical circuit components, (2) it should utilize the available RC 10/24 mechanism without impairing its efficiency in any way for routine recording, (3) it should provide for a wide range of delay times, (4) it should provide for continuously variable delay if possible, (5) it should provide for continuous recording of the speech effects produced, and (6) it should be inexpensive and unobtrusive. Figures 1 and 2

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[1] This compares with an optimum delay of .18 second found by Black (*2*).

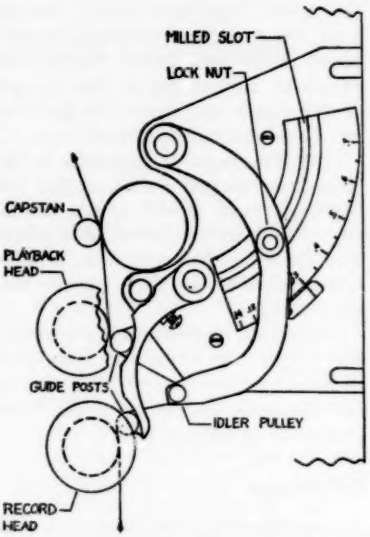

FIGURE 1. Diagram of the time delay device.

present the results of the attempt to accomplish these ends.

As the illustrations indicate, the entire mechanism is mounted on an aluminum plate which is positioned on the face of the tape transport mechanism by means of two centering pins and held in place by two bolts into the base plate and two into the mounting rack itself.

In place of the single tape guide usually positioned between the recording and playback heads, two steel guide posts are mounted on a brass arm, making it possible to hold the tape in contact with both heads while at the same time allowing for the tape to be taken over a movable idler pulley between.

The adjustable idler pulley and swinging arm assembly is the critical mechanism for increasing the length of path between the record and the playback heads. Rigidity of construction and strict alignment are necessary to prevent the tape from riding to one side or the other and disturbing the normal tape tracking. On the present mechanism a slight crowning was given to the ball bearing idler pulley to prevent lateral movement of the tape.

The side to side positioning of the tape appears to be especially important with slightly worn heads, for if a groove has been worn in the playback head the tape will ride up over the lip of the groove, interfering with output and frequency response.

Through the use of the seven and one-half inches per second and 15 inches per second tape speeds provided on the RC 10/24 tape transport mechanism in this laboratory the range of available delay times is variable from .14 second to 1.40 second. In order to extend this range into the shorter delay times an accessory slip-on capstan and idler have been designed to provide for a 30 inches per

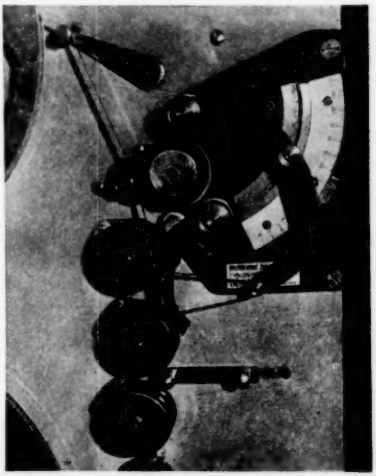

FIGURE 2. Photograph of time delay mechanism in operation.

second tape speed. This speed extends the delay range downward to .07 second.

With the accessory capstan and idler in use an additional guide pin must be used to prevent the tape from being pulled from the playback head by the larger capstan diameter. A special guide post was easily designed to replace one of the regular mounting screws of the capstan assembly.

The calibration of the time delay scale has been carried out in the manner suggested by Marple and Morrill (5).

One limitation of the equipment as presently operating is the slight tendency toward interference with tape speed and speed regulation at the greater delay times, particularly at the 30 inches per second speed. This is probably the result of additional friction around guide posts and idler pulley plus a decrease in stability of tracking. It seems likely that a few relatively simple design changes, such as roller bearing guide posts, could effectively reduce this tendency. Although no perceptible change was noted at the .18 second setting, recording in the normal manner and playing back at a .5 second delay setting produced a speed change of roughly 1.6 per cent. At all long delay settings flutter, which was not noticed in speech, was slightly increased—roughly in proportion to the amount of delay.

In work done in this laboratory the above described speed changes have not proved of practical importance. It has been found that by appropriate adjustment of the torque on the supply reel motor the problem can be eliminated in critical cases.

One other possible drawback to the apparatus designed is the fact that the playback head shield is not usable when the delay mechanism is in place. The resulting change in noise level is not detectable, however, by the listener.

Despite the drawbacks the mechanical adapter described has been used to considerable practical advantage in the phonetics laboratory at the University of Washington.

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Modern Linguistics And Recovery From Aphasia

M. H. Scargill

IN AN EXAMINATION of the literature on language training in cases of aphasia, any linguist[1] would at once be struck by the almost complete absence of any reference to his particular field of study and to its possible value to the speech therapist. Goldstein (*4*) did, indeed, stress the fact that modern linguistics might make a contribution to reeducation in aphasia, and his bibliography refers to Paul's *Principles of Language*, a book now out-of-print. Weisenburg and McBride have no references to the work of linguists (*8*); neither has Granich (*5*). Wepman (*9*) does make reference to the findings of educational psychologists who are interested in reading problems; but it has no mention of the work of such eminent scholars as Bloch, Trager, Harris, and Fries, who have all made significant studies of language. In fact, the greater part of the literature on aphasia proceeds to discuss questions of language training with a disregard for the fact that such training is on the verge of a complete revolution as a result of the work of modern linguists.[2]

The traditional grammars, with their insistence upon 'meaning' as the sole means of language learning, can be of little aid to a therapist who has great difficulty in communicating 'meaning' to his patients at all. The confusing definition, for example, of the 'subject' of a sentence as 'the performer of the action' is obviously of no help to the therapist who can see for himself that in such a sentence as *The dog was beaten by the man* the subject is not performing any action.

Nevertheless, it does seem that when 'grammar' is handled at all by the speech therapist, it is actually along these traditional lines. And yet there is a new approach to the teaching of languages which is not based upon 'subject,' 'object,' 'modifier,' and all the other paraphernalia of 'formal grammar.' Would it not be worth the speech therapist's while to examine the possibilities of the new approach to language learning and to language teaching?

So far as the teaching of sounds and of individual words is concerned, the linguist would have little to add

[1]The reader is asked to remember that the author writes about the subject of language training primarily as a linguist. This article is not intended as a statement of therapeutic procedure, but it puts forward certain principles that may one day be integrated into the total procedure of rehabilitation in cases of aphasia.

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[2]I should like to mention here the great interest displayed in modern linguistics by Dr. Harlan Bloomer of the University of Michigan. It was at the University of Michigan's Speech Clinic that I first became interested in the problems discussed in this article.

to the excellent methods of speech therapists. But, even here, it might be useful for the therapist to have an accurate survey of the phonemes of English and some account of their frequency of occurrence. A very convenient table of English phonemes may be found on pages 48, 49, 52 of *An Outline of Linguistic Analysis* by Bloch and Trager (*1*). A survey of English consonant clusters can be seen on pages 17-18 of a book by Fries (*2*). An admirable study of American intonation is to be found in Pike's *The Intonation of American English* (7).

It is when he comes to the over-all attitude of the speech therapist to language training, that the scientific linguist is likely to be dismayed. Far too much insistence is placed on language as being a collection of lexical items; for a man may well know many words in a language and yet be unable to understand or be understood simply because he does not know the 'grammar' of the language, the devices by means of which the language indicates 'subject' and 'object,' 'verb' and 'noun,' 'statement' and 'question.' For example, what is the difference between *The boy is here* and *Is the boy here?* It is certainly not a matter of vocabulary. It is a matter of arrangement and intonation; and a person's inability to respond to a question may well be an inability to distinguish the pattern of the question from the pattern of the statement and not a matter of vocabulary at all.

Modern Linguistic Theory

If we analyze a simple English sentence, we see at once that its total meaning is much more than the meanings of its separate words. It is the sum of the lexical meanings of the words plus their grammatical meaning (that is, their meaning as 'subjects,' 'modifiers,' elements of a 'command,' and so on) plus the meaning given by intonation patterns. Let us examine this sentence: *The red house stands on the corner.* Now, how do we understand the total meaning of this sentence? There is no doubt that we understand the 'meanings' of the words as words. But how do we know that it is giving information and not asking for it? How do we know that there is one *house* only? How do we know that *red* 'modifies' *house*, whereas *on the corner* 'modifies' *stands*? It is not a matter of 'meaning.' Change *red* to *blue*, and it still modifies *house*. Change *on the corner* to *by the mill*, a complete change of meaning, yet the group still modifies *stands*.

Briefly, our understanding of the above, or of any, sentence in English is based upon our understanding of the various devices by means of which English signals such things as 'question,' 'command,' 'subject,' 'modification.' These signaling devices allow us to distinguish between the structure of a question and the structure of a request or statement; they allow us to recognize words as belonging to various classes, having special forms and special positions in the sentence. We know that *house* is tied to *stands*, as its 'subject,' by reason of the position of *house* and by reason of the presence of *-s* on *stands* (compare *The red houses stand*, where a change in form makes a change in meaning). *House* belongs to a special class of words marked (a) by distinctive forms: *house, houses* compared with *stands, standing;* (b) by the fact that it is often preceded by such special markers as *a, the, each, some.* We know that any word that can be

placed between one of these special markers and such a word as *house* 'modifies' that word: *a red house, some blue flowers, each little boy.*

To 'understand' a language, then, one must know not only the lexical content of that language, but one must also know the devices of position, form, and intonation that signal the various types of sentences, the relationships of words as subject, object, modifier, and the distinctive forms that mark words as belonging to separate classes that are not confused. For example, a noun is recognized as a noun, not by its meaning, but because it is often accompanied by distinctive markers (*the, a, an*), because it has certain formal features (a plural, a possessive), because it has a certain relationship with a verb which other classes of words do not have. An adjective is recognized and used as such because of its distinctive forms (*finer, finest*), because of its fairly fixed position (most often it is preceded by *the, a* and followed by a word of the 'noun' class). A statement is recognized as a statement because it has the basic pattern *noun plus verb* as opposed to the *verb plus noun* of the question. In a statement and in a question the 'subject' agrees with the verb in number and person. In a request there is no such agreement: *The boy closes the door; The boys close the door; Close the door.* Within the sentence, words have well-defined positions. The 'subject' normally precedes the verb. The modifier of a noun precedes the noun; but the modifier of a verb often follows the verb.

Appraisal of Testing and Re-Education

Because of the general attitude now current towards language and, therefore, towards certain disturbances in language, it is natural, but unfortunate, that testing procedures used in determining language disturbances concentrate only on lexical items. The fact that a patient knows the dictionary meanings of certain words does not necessarily mean that he knows how to use them or to respond to them in the syntactic patterns that constitute recognizable speech. The fact that a patient cannot respond to a certain question or command might well be the result of his inability to recognize, not the words as words, but the structural pattern of the question or the command.

It seems logical, therefore, that any test to be used in aphasia would be so designed as to take into account the two essential 'meanings' of language: the grammatical (often called 'linguistic') meaning and the lexical meaning, both in framing questions and in assessing answers in purely language tests.

A type of question frequently used in tests is of this kind: *What is the color of ink? Who is that boy?*

Here perhaps is an error. This particular type of question is identical in structure with such statements as *Blue is the color of ink. He is that boy.* We recognize the questions as seeking information only because of their intonation and because of the presence of the special interrogative words, *what* and *who.* Now, it may well be that the intonation pattern has no meaning for the patient. If this is so, his recognition of *Who is the boy?* as a question depends entirely on his knowledge of the special word *who.* If he does not recognize this word, then he takes the sentence to be a statement and, naturally, makes no response. Statements do not require answers.

Fortunately, in our language there are other ways of getting information and perhaps they should all be used so as to make quite sure that it is not the syntactic patterns that confuse your patient. The use of a type of question which does differ in pattern from a statement might help. Instead of *What is the color of ink?*, one might ask *Do you know the color of ink?* Here the linguistic structure has the verb first. In addition, a request might be used to get an answer: *Name the color of ink.* The examiner should be ready with all types: *Who is that boy? Do you know that boy? Name that boy.*

Perhaps an essential part of any testing procedures in aphasia should be a section on 'Recognition of Syntactic Patterns' or 'Awareness of Linguistic Meaning.' Such a part of a test would not be impossible to construct. For example, a very easy test to administer might require the patient to show his ability to supply the missing words in well-marked linguistic structures: *Which of the following words can be used in the blank space? RUNS, BIG: The large dog* _____ *quickly.*

In methods of reeducation, too, the same attitude to the language exists. Either the language is regarded as a matter of lexical items only, or the grammar is taught according to the false traditional concepts. For example, one method of teaching tries to associate 'nouns' (i.e., names) with 'verbs' (i.e., names of actions). It suggests that once the patient has acquired the word *water,* he next must be taught *water drink* in order to get the association of noun with verb. Now nouns and verbs are rarely used together in this way. Always we find some distinctive signal of meaning present: *water to drink* or *drink the water.*

It would be useful, then, in teaching vocabulary to teach at the same time the constant structures that signal 'modification,' 'command,' and so on. If the patient grasps the command, *Drink the water,* he has a useful pattern into which he can place new words: *Read the book; Close the window.* He has useful structures of modification: *Food to eat, Work to do.* All words should be acquired as they are used in the language, not as they are found in a dictionary and certainly not in linguistically unsound juxtapositions.

One therapist cites the case of a patient who could respond to one simple request. Presumably the patient had acquired the pattern of the request in English. But, this patient could not respond to a double request: *Look at the radio and then at the window.* It is easy to see why the patient was confused. The source of the trouble is the word *then. Then* is one of those words which have no distinctive shape: no plural, no possessive, no preterite. It must be learned as an item. However, it frequently accompanies a verb. Now in the double request, *then* appears in the position of a verb. Hence, the patient was perhaps quite logically trying to make it conform to the pattern of a verb: (a) *Look at the radio,* (b) *Then at the window.* If the double request avoided ambiguity by giving *then* an accompanying verb, perhaps the patient could understand the double request: *Look at the radio and then look at the window.*

Most of the writers on language training in aphasia stress the use of exercises asking patients to complete sentences. Now, as an exercise in

forming sentence patterns this might be valuable, provided that there is no danger of ambiguity as the result of a failure to provide the missing words with distinctive markers or distinctive forms and positions. However, all too often the words which are to be supplied by the patient (even where possible words are given by the therapist) are not accompanied by any clear signals which would allow the patient to associate the missing words with other words of the same class which he knows. For example, any sentence requiring completion after the words *is* or *are* can be very confusing: *The house is* _____. Now the missing word could belong to the class represented by *green*, to the class represented by *there*, to the class represented by *painted*. It could not belong, however, to the class represented by *boy*, although it could belong to the class represented by *to let* or *for sale*. The choice is too great. But if the missing word is given a distinctive marker or placed in a distinctive position, then the patient who is trying to find it can at least draw on his knowledge of the use of words of the same class. For example, there can be no doubt about the kind of word to be used here: *The house is a* _____ *one*. The word must be of the *red* or *painted* class, that is, a 'modifier.' Any other kind of word, no matter what its meaning, would not fit. It would be linguistically impossible. Words to be supplied in such necessary exercises as these should be chosen as clear linguistic items as well as lexical items.

Learning and Understanding a Language

To understand a language means to be able to make and respond to the lexical and structural meanings of that language. How is such understanding acquired? It is acquired by a long process of trial and error. A child usually has the basic patterns before he has the basic vocabulary. He will form a whole sentence composed of two words plus several 'meaningless' sounds. The 'meaningless' sounds are actually structurally meaningful. They represent the patterns of modification for which the child has no lexical items. As the child matures, he learns the difference between *Is baby ready?* and *Baby is ready* through the difference in the required responses. It is not necessary to explain to him that one is a question and that the other is a statement. The adult aphasic has not the time to learn by trial and error in this way. He may need to be provided quickly with a basic vocabulary, suited to his special needs, and also with the basic structures and patterns for getting and giving information. If so, he does not require to know the names of any of these patterns or anything at all in the way of 'formal grammar.' He needs constant practice in the use of the signaling devices of English.

So far as the use of signaling devices is concerned, no doubt every speech therapist would be delighted with a handbook that would give him all the basic information in the form of text and examples. It might be to his advantage, therefore, to be aware of two fairly recent publications by Harris (*6*) and Fries (*3*) which lay the foundations for such a handbook.

The book by Harris is an account of the methods used by some structural linguists in determining the phonemes, forms, and structures of a language. Fries' book is the product of the application of such methods in a descriptive analysis of the structural

devices of English. Fries' work will be of the most immediate value to the speech therapist. Harris' book will interest those who wish to understand the principles behind the work of Fries.

Application of Structural Linguistics

This is not the place for a full review of *The Structure of English;* but it might be useful to outline some of the contents of the book and note their possible application to language reeducation in aphasia in cases where the therapist feels such reeducation to be necessary.

Fries analyzes the basic patterns of English sentences with regard to their structures and arrives at an excellent description of the patterns which ask for or give information, which give commands, which begin or continue conversations. The description is not based upon the lexical meanings of words. It is based solely on matters of form and structure. This means that the sentence patterns necessary for basic conversation could be taught to a patient when the meanings of the separate words are taught. Into these unchanging patterns words can be fitted as required. All patients need to know the same structures, but they do not all need the same vocabulary. The grammar is constant: the vocabulary is not.

In dealing with the words that make up sentences, Fries, again proceeding almost entirely on a description of formal differences, groups words into five classes. Words of four of the classes can be identified by their special forms and positions. Words of the last group, such as *may, can, will,* must be learned as separate items. Now, in the provision of a basic vocabulary, determined by the special needs of each patient, the therapist could select and group the chosen words as words with particular forms (*small, smaller, smallest; boy, boys*) and, following a further analysis by Fries, as words with special positions in sentences. For example, words such as *house, brush, bench* all have the same endings when compared with words such as *small, large, clear.* These words also appear most frequently with verbs, either as 'subject' and thus tied to the verb in number or as 'object' (following the verb and not agreeing with it in number). Such words as *small, large* appear most frequently between *the, a, each, some* and words of the *house* type. These formal and structural features are the same for all patients. The lexical features may be varied to suit individual needs. But the patient can thus be taught every word as a meaningful structural and lexical unit; e.g., as part of a structure of modification, *water to drink, the cold water,* or as part of the structure of 'subject and verb,' *The fire smokes; The fires smoke.* Thus when a patient acquires a new lexical item, he knows by experience just what use he can make of it. When he is asked to complete a sentence, he knows at least *what kind of word* is required.

In a most interesting section of his book, Fries describes the kind of responses that are elicited by various types of question. For example, a question beginning with *who* usually gets a name offered as an answer. A question beginning with *why* often receives an answer beginning with *because.* A statement gets as a response either a denial or spoken or silent agreement. A request produces an action and, sometimes, speech as

well: *Open the window. Certainly* (opens it). From such information as this, the therapist could compile a series of typical conversations in which patients might participate. The important thing would be to teach the patterns; then selected and varied lexical items could be placed in the patterns. For example, any patient who has learned to ask or reply to questions of the *why* or *who* type can make new questions and answers as his vocabulary grows.

A section of Fries' book deals with the recognition of 'what goes with what,' regardless of meaning. For example, let us give to words of the *a, an, each, the* type the number 1, to words of the *house, bush* type the number 2, to words of the *big, small* type the number 3, and to words of the *seize, break, lock* type the number 4. Let us take the sign = to represent agreement in number. Then the formula 1 - 3 - 2 = 4 can be filled as a statement with a variety of lexical items. But word 3 will always modify 2, and word 2 will always be the subject of the sentence: *The small object breaks; The small objects break.* These are structural meanings which every man must learn, be his vocabulary technical or dialect, limited or broad.

This has been a sketchy description of what linguistics might offer to the speech therapist, and it has said little about vocabulary and intonation. But perhaps it will stimulate interest in a profitable field of study. A carefully designed series of examples of the structural patterns of English into which almost any kind of vocabulary can be fitted, according to the needs and progress of individual patients, should be of great value wherever basic information in the language is needed as a part of the total program of rehabilitation.

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Language Disorders And Parent-Child Relationships

Dorothea McCarthy

RECENT RESEARCH and clinical investigations bring out increasingly the fact that language, and particularly its oral form, speech, is an important indicator of the state of an individual's mental health. Clinicians are just beginning to read the linguistic barometer. Goodenough (*18*), for example, considers that 'some form of the free-association method offers one of the most promising approaches yet available for the study of personality differences.' She has developed refinements of the familiar word association tests (*17*) which show that patterns of associations of words have diagnostic significance with reference to the broad aspects of personality. It is also becoming evident that the emotional climate prevailing in the home provides experiences which have important influences not only on the child's personality adjustment, but also on his language development.

The cultural milieu in which children are growing up in present-day America places increasing emphasis on the vital importance of all forms of communication: listening, speaking, reading and writing. Increasingly large numbers of individuals of normal mentality and sensory endowment are experiencing difficulty in acquiring facility in the various essential forms of communication. This phenomenon has in turn given rise to the several professions concerned with remediation, such as speech therapists and remedial reading teachers who, together with clinical psychologists and psychiatrists, are concerned with alleviating the various language disorders. Evidently something is going wrong in one phase or another of the language development of increasingly large numbers of children.

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Language Disorder Syndromes

When the child whose speech is not developing normally is examined carefully it is usually found that there have been anomalies of language development present in one form or another throughout his life (*3, 9, 27, 43*). Whether a child is referred to a speech therapist, to a psychologist or to a remedial reading teacher is largely a matter of timing. It is a question of when a particular symptom becomes intolerable to someone in the environment, and what facilities are available in the community.

Language disorders rarely appear singly or in isolation. In the clinic at Fordham three-fourths of the nonreaders had also shown delayed speech, lisping, stuttering or articulatory defects at one time or another (*27*), but no one had been sufficiently concerned to seek help for the earlier

symptoms. The majority of these children had two or more such oral symptoms in combination with the reading disorder which eventually brought them to the clinic. It was also found that about one-fifth of the stutterers had had difficulty in learning to read and two-thirds of them had additional speech symptoms. Yedinack (*43*) found 40 per cent of a group of second-grade poor readers also had articulatory defects, and 38 per cent of a group of cases identified as having articulatory defects also suffered from reading disabilities. Huyck (*21*) cites a summary by Rutherford which states that 25 per cent of dysphemia cases have reading and writing defects or other speech defects and 18 per cent of dysarthria cases show similar syndromes. The more general term *language disorder* seems preferable therefore, since it helps to focus attention on the entire syndrome and its causation, rather than on a single symptom which happens to be predominant at a particular time.

These language disorders tend to appear in children who manifest certain types of personalities. Some present a pattern of shyness, timidity, immaturity and tension which often conceals pent-up hostility and anxiety. Others present a picture of aggressiveness, bullying and predelinquency in which their tension and anxiety are shown overtly in antisocial behavior (27).

It appears profitable, then, to study the home backgrounds of these children for clues as to why some develop language disorders and others do not.

Infant Speech

Speech involves probably the most intricate motor coordination of which human beings are capable, and its symbolic nature is the distinctive feature which sets man apart from animals. It is a phenomenon which has its onset in most normal children (that is, among those who are not mentally defective or deaf) some time during the second year of life.

The speech mechanisms are first used in infancy for other biologically important functions, namely breathing and eating (*35*). Children do not begin to use real language until after several things have occurred in their physical and motor development. Respiration must first become well established and be under satisfactory control. Front teeth must also be acquired and form a front wall of the oral cavity, so that dental and postdental sounds can be uttered (*26*). Babies do relatively little articulate babbling until after they have had considerable exercise of tongue and jaw muscles in the mastication of solid food. Apparently the use of nasal sounds is associated with the child's assumption of the erect posture in sitting and standing. Speech, then, is the most refined and last acquired use of the complex organs involved, and it occurs in a total developing organism according to regular, but as yet relatively little understood, laws (*26*). It stands to reason, however, that the kind of nurture the child receives during this important formative period will have much to do with determining the facility with which he acquires speech. Emphasis must be placed not only on the nurture in physical terms, such as the kinds of food offered him and at what ages, and on the amount of time he is propped up in a sitting position, but also on the way in which these things are done. If these ministrations are given by a smiling, affectionate mother, or mother substitute, who has a genuinely good relationship with the child, he develops linguis-

tically more normally than when the same physical care is given impersonally as a duty by a disinterested person.

Aldrich, Norval, Knop and Venegas (*1*) have shown that the more individualized nursing care babies get in a hospital nursery, the less crying they engage in. Naturally, the less they cry the more waking time there is available for spontaneous babbling. Irwin's amazingly painstaking techniques (*22, 23*) have done much to unlock the mysteries of infant speech, and they show that many of the differences in language development which cruder techniques have revealed among older children, especially the differences between upper and lower socio-economic classes, are present even in the first six months of life.

Children Without Families

Brodbeck and Irwin (*6*) have shown that babies who have been brought up in normal family environments vocalize more, and in a more advanced manner than babies reared in an institutional setting. Fisichelli (*13*), who also studied the speech of infants, found her institutionalized babies using fewer phonemes in their babbling and showing lower consonant-vowel ratios than the Brodbeck and Irwin subjects who were living in family situations.

Freud and Burlingham (*14*) in England, Roudinesco and Appell (*32*) in France, and Goldfarb (*16*) in New York, have all shown that young children separated from their families and raised in institutions are seriously retarded in all aspects of their development. When they are given an improved regime with more 'mothering' care from attendants, they improve in motor development, but their language development shows the least improvement and tends to show more or less permanent impairment. Buxbaum (7) states that 'severely neglected children and those whose attachments to adults are interrupted and infrequent . . . are slow in learning to speak and may remain retarded in speech throughout their lives.' These children she describes as 'anxious, insecure, inhibited children who were punished for self expression or suffered the pangs of hunger, cold and loneliness.'

Williams (*41*) and his associates at Iowa also showed retardation of orphanage children at the preschool level in vocabulary and in other aspects of language development. These institutionalized children may be thought of, then, as those who enjoy a minimum of individualized adult contact in early childhood.

Amount of Contact with Mother

At the opposite extreme, there are 'only' children brought up in their own homes who experience the most intensive contact with the mother and other adults over the longest period of time. Davis' study (*8*) indicates that only children, particularly only girls, are the most accelerated in language development. Such children are seldom found among the clients of speech and reading clinics. Between these two extremes are single children with siblings who have the concentrated attention of their mothers in infancy, but who must share the mother's attention with brothers and sisters either from birth or from an early age. Such children are in between institutionized and only children in their language development.

Another interesting group are the 'multiple birth children,' such as twins, triplets and the famous Dionne quintuplets (*5, 8, 28*). All of these groups

who must always share the mother from earliest infancy show retardation in language development, and the degree of retardation seems to vary directly with the number of same-aged children involved. It would seem, then, that there is something of a gradient related to the intensity and duration of the mother's attention.

Quality of Mother-Child Relationship

The mother is normally the child's first language teacher in our culture, and it is she who furnishes the example for the baby to imitate (*39*). It is her voice that he echoes back in his babbling, and her smile and fondling which most often elicit his cooing and other prelinguistic utterances. Studies indicate that it is not merely this quantitative aspect of the mother-child relationship which is important, but that the quality of that relationship undoubtedly has a significant influence on the acquisition of language (*36*). The mother reflects her own personality in the kind of nurture she gives her baby (*34*). The very way she approaches motherhood, whether she welcomes or dreads the child's arrival, whether she feels adequate to care for him, or whether she is tense, worried and uncertain in everything she does for him, whether she is happy and talks to him as she goes about her tasks or pushes the baby carriage, whether she is silent and preoccupied while giving physical care or is impersonal and merely allows the child to vegetate most of the time, are the kinds of things which are important in determining whether his language development will thrive, or be stunted, or distorted in some unfortunate way.

The smothering, overprotective attitude of mothers whose children lisp or cling to other forms of infantile speech is familiar to clinical psychologists and speech therapists. Such children are literally kept babies emotionally, and their speech is merely one reflection of what such overprotective mothers are doing to the developing personalities of their children (*42*). The dire effects of too-ready anticipation of the child's needs, and the failure to require him to speak and express these needs, as well as the bad effect of repeating the child's baby-talk back to him instead of giving him the correct model to imitate are also well known. The emotional immaturity of parents who go in for that sort of child-caring practice is all too evident. Such children are best helped by assisting their parents to release them and to permit them to grow up emotionally, as was so well shown in the excellent study by Wood (*42*). The roots of such problems are usually found in the childhood experiences and parent-child relations of the previous generation.

It should also be remembered that the mothers of stutterers are usually overprotective, especially in regard to matters of health (*10*). They are tense, perfectionistic parents, however, whose overprotectiveness is often a disguise for real rejecting attitudes. Many stutterers, in spite of severe hostility toward their parents, are so ambivalent as to be unable to leave home even as adults. Others who do succeed in breaking home ties, often experience real improvement in their speech problem as they take this step toward emotional maturity.

Another pattern of parent-child relationship, which is perhaps less well understood than that of overprotectiveness, is that of the parent who ignores, neglects, or overtly rejects the child. Some children who find themselves in such a hostile world develop

a 'basic anxiety' so well described by Horney (*20*). These children may withdraw into mutism and perhaps eventually become schizoid personalities as described by Despert (*11*). Others attempt to retaliate against the hostile environment and become aggressive and hyperactive, indulging in excessive use of gestures and motor behavior with a minimum of language, which they often use only to express hostility and resentment either in content or manner of speech. Deprived of parental affection, these children never develop respect for parental authority, and carry over hostile attitudes towards teachers and other parent surrogates in the community. They do not develop wholesome friendships, and usually drift into patterns of delinquent behavior, as their limited facility in dealing with words and symbols renders them unable to socialize well, or to profit by the highly verbal curriculum of the school (*27*).

It has long been known that homes of low socio-economic status (*25*), bilingual homes and homes in rural areas, tend on the average to produce children whose linguistic development is considerably slower than that of children from upper socio-economic levels, those in urban areas and those from homes in which only one language is heard. Data are just beginning to emerge, however, as to the dynamics of the cultural patterns present in different kinds of homes which seem to be causally related to the linguistic development of children. For example, children in lower socio-economic levels ask fewer questions than those in upper socio-economic levels (*25*). Could it be that they receive fewer and less adequate answers?

Milner's interesting study (*29*) of the home life of children who as first-graders were in the lowest third of their classes in language achievement scores, showed that these children did not have breakfast with their parents, and that they did not engage in two-way conversation with significant adults in their homes before or after school. They were likely to hear only a few commands or directives, were exposed to considerable corporal punishment and had little opportunity to use language themselves. In contrast, the children scoring high in language achievement did engage in two-way conversation with important adults in their homes, they did eat meals with their parents regularly, had much more opportunity to use language meaningfully in the home, and their discipline was on the verbal rather than on the physical level.

Lafore (*24*), who studied parent-child relationships of preschool children in more favored homes, found that even well-intentioned parents who apparently loved their children very much, were often extremely ignorant and inept in the ways in which they handled their children. Although greatly concerned about their children's intellectual development, they made relatively few attempts to assist them in language growth. Parent-child contacts helpful to language growth were the least frequent of all the types studied.

Apparently, lower socio-economic status itself is not causally related to poorer speech among children of the lower classes. It is likely that concomitant patterns of family life similar to those experienced by Milner's poor readers and which are more prevalent in lower socio-economic groups are the more important influences. These kinds of human relations which provide few stimulating situations affording children opportunities for effective speech can and do occur at all socio-economic levels, but are

most often found in less favored homes. In order for children to thrive linguistically, the home must foster the desire to acquire language skills and parents must help children build meaning into words in their everyday life situations.

Experiences Afforded by the Home

The fact that variety of experience is important in enlarging children's vocabularies has long been understood and schools take many steps to broaden the young child's experience in order to add to his vocabulary. Homes, of course, differ tremendously in the variety of experiences they afford young children. They differ, not only in toys, gadgets and furnishings available, but also in the opportunity to travel, to go on vacations, to camp, to the seashore, etc., where new things are to be seen, and new activities are engaged in. Such experiences extend the child's knowledge and his store of usable words. With the increasing mobility of the population, babies now live an appreciable percentage of the time in cars. Although they may not put down as deep roots as children of former generations did, they certainly have more varied experiences which are linguistically stimulating.

With the disappearance of domestic help, fewer and fewer babies are being cared for by ignorant and often illiterate nurses whose speech affords a poor model, and they are spending more hours with their parents than was true a generation ago. These factors in the changing social scene probably mean that there are fewer children coming to school with extremely limited experiences. Vacations are enjoyed by increasing numbers of families, and with the five-day week there is more leisure time for parents to spend with their children and to take them to zoos, museums and other places which extend their experiences. The mere fact of the availability of these leisure hours, however, does not assure the child's optimum language growth. The important thing is how those hours are spent.

The vicarious experiences of television are now beginning to impinge on the present generation of children. It is certain, however, that larger and larger numbers of children are having their ears bombarded with language a larger percentage of the time than formerly, and they are enjoying excellent visual aids to the comprehension of that language, so that seldom nowadays is a child found whose experience is as seriously limited as that of many underprivileged children of a generation ago. The gap is being narrowed between favored and underprivileged homes economically and in many other respects, yet there are still many linguistically and emotionally underprivileged children at all socio-economic levels. Their deprivations are more subtle and therefore harder to detect and to understand.

The mother who encourages her children's excessive use of television to keep them 'out of her way' is not merely depriving them of opportunities to practice language; she is depriving them of herself, and is not giving them the real, vital interpersonal experiences such as story-telling, picnics, tea-parties and the like which constitute the very essence of family life. What the benefits and disadvantages of these many changes in our contemporary social scene will be, only time can tell.

Neighborhood Influences

As the child gets older and has additional contacts outside the home it becomes increasingly important for

him to identify with his peers. Now, the neighborhood contacts become definite influences on the child's speech, and the geographical location of the home and its similarity to, or difference from those in the environs will have a bearing on the child's speech. An interesting study by Anastasi and D'Angelo (*2*) on the language development of five-year-old Negro and white children showed that the Negro children were more retarded than the white children when both groups were isolated from each other. Negro children living in housing developments with, and associating in playgroups with white children, however, showed no language retardation. Possible selective factors, such as admission of superior Negro families to mixed housing developments, however, were not controlled.

Studies of the misarticulations of older children usually present a discouraging picture. Sayler (*33*), for example, found little improvement in the articulation of children from grades seven to twelve, and Spriestersbach and Curtis (*38*) report that older children are more consistent than younger children in their misarticulations. Perhaps findings of this sort can be accounted for in terms of the waning of home influences in adolescence. Hockett (*19*) observed the marked flexibility of the young child's phonemic system which he says develops by splits and contrasts until a reasonable facsimile of the adult phonemic system heard in the environment is attained. He found, however, a loss of flexibility by the age of puberty when the sounds of one's own speech sound 'right' or 'wrong' according to how closely they resemble those used by the peer group. This is the age, then, when parents with high speech standards and teachers experience unbeatable competition from the neighborhood associates. A few hours in the classroom, at home, or with a speech therapist can scarcely counteract the powerful influence of the many more hours spent with the gang as the adolescent strives for independence.

Bilingualism

The problems in language development and speech encountered by the child from a bilingual home are also familiar. All studies indicate that children who are exposed to two languages simultaneously in the preschool period show retardation in both languages, and that even the combination of the two vocabularies does not compensate for the lack of terms in a single language. In the past, the emphasis has been on the intellectual confusion of the bilingual child, but more recently his problem has been reconsidered in terms of emotional dynamics. It has already been pointed out that the language heard in infancy has deep emotional roots. These cannot be discarded easily as the child enters an environment in which another tongue is spoken, and deep emotional harm may be done to the bilingual child if he is forced to suppress all verbal expression associated with the parental culture. These early emotional associations by which children identify with their parents and their early environment, are the basic reasons why foreign accents are often so difficult to overcome. If children are made to feel that the language of their parents is taboo, they may develop severe feelings of guilt about using the parental tongue, yet unconsciously and emotionally they cannot give it up completely (7).

Spoerl (*37*) has shown that bilingual college students are much more

maladjusted than monolingual students, and the maladjustment was most evident in the area of intra-family adjustment. Bilingual students showed extreme scores on tests of social values, some having accepted and identified with the parental culture and others having rejected it. Spoerl states that the major conflict for such cases is within the home. Lack of identification with the parent environment is often coupled with a rejection of the cultural background of the parents, and the parental speech becomes for the bilingual child a symbol of the parental culture. Most of the maladjustment, Spoerl considers, is environmentally determined, and is not the result of mental conflict engendered by the complexities of thinking or speaking in two languages. In association tests she found that bilingual students, significantly more often than monolingual students, respond to the word 'language' in terms descriptive of *the act of speech*. This, she interprets as indicating that there is in his mental organization a residual effect of the emotional turmoil and mental effort which must have been present in the early days of his school career when English was not for him a facile medium of expression.

It appears then, that speech defectives when studied carefully for home adjustment, family background and personality factors seem to show marked abnormalities in these areas as well (*3, 9, 11, 15, 30, 31, 37, 42*). Brief examples from several of the major language disorder categories may serve to clarify this point.

Delayed speech. Beckey (*4*) compared 50 children with delayed speech with 50 who spoke at the normal age. She found that such children cried easily, tended to play alone, and did not want as much adult attention as the normal speakers. They suffered from many respiratory ailments, had young, nervous mothers and came from family stock in which there were other speech defectives, left-handed individuals and mental defectives.

Stutterers. Glasner (*15*), who studied 50 young stutterers two to five years of age, found that 54 per cent had feeding problems, 27 per cent were enuretic and 20 per cent had exaggerated fears or nightmares. Moncur (*31*) compared 48 stuttering children five to eight years of age with a matched control group. It was found that every stuttering child exhibited several symptoms of maladjustment in addition to his speech problem. Significantly more of the mothers of the stutterers than of the control group employed harsh disciplinary measures, threats, shame, humiliation or corporal punishment. They admitted more inconsistency in discipline and more conflict with the father over discipline. They tended to be more indulgent and pampering, especially in regard to eating habits, and there were more illnesses, accidents and unfortunate health conditions affecting the households of stutterers. Despert (*10*), in her study of 50 stuttering children states, 'probably the most common finding is anxiety, primary, not secondary to the speech difficulty, which is reported by all investigators.' She concludes, 'Pressure on the part of neurotic, often compulsive, mothers at critical periods of the speech development in somatically sensitized individuals is viewed as a catalyzing agent for speech and associated pathology.' In another study Duncan (*12*), who studied the responses of stutterers to the Bell Adjustment Inventory, found that all the items which successfully differentiated

stutterers from non-stutterers had to do with family relationships.

Poor readers. Among non-readers, Missildine (*30*) found that nearly all of his group harbored severe affective disturbances involving some member or members of their families. Twenty out of 30 came from homes where the mothers were overtly hostile or of a coercive, perfectionistic nature. Stewart (*40*) describes the parents of bright children who are poor readers as 'more indulgent, overprotective and capricious than they are rejecting.' Beck (*3*) who studied the nursery school records of fifth-grade poor readers found that they had presented a variety of symptoms indicative of parent-child conflict even in the preschool period.

Summary

In conclusion, it may be said that: (1) Language disorders are extremely complex and do not appear in isolation. (2) Children presenting nonorganic language disorders often seem to have disturbed family relationships which render them emotionally insecure with various patterns of accompanying symptoms of maladjustment. (3) The home atmosphere as determined by the personalities of the parents seems to be the most important single factor influencing the child's acquisition of language. (4) Therapy directed toward the language symptoms seems to be most effective when it is preceded or accompanied by psychotherapy, either group or individual, for the child and for his parents.

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Some Factors In The Intelligibility Of Cleft-Palate Speech

Betty Jane McWilliams

IN THE FIELD of cleft-palate speech, diagnostic and therapeutic procedures and theories have resulted from clinical observations more than from objective evaluation and study. A fundamental viewpoint has grown up, and that viewpoint has not often been challenged. There has been almost universal agreement—in word or treatment—that cleft-palate patients suffer from hyper-nasality resulting from inability to get adequate velar-pharyngeal closure. This assumption has led to therapeutic policy designed to accomplish velar-pharyngeal closure as a first step in treatment.

The development of this closure has been approached in various ways, but blowing exercises have probably been most frequently suggested. Kantner (*6*), Moser (*8*), Gaines and Wepman (*3*), to name but a few, have stressed various blowing exercises designed to help the patient direct the expired air steam through the mouth rather than through the nose. These techniques have been used in an effort to build palatal control, to help the patient gain a sense of orality, or to apply a type of physical therapy to the palatal and pharyngeal areas. Regardless of stated purpose, the goals of this therapy have been the same—the reduction of nasality through improved velar-pharyngeal closure.

The blowing tradition has continued to the present day in many clinics in spite of the fact that clinicians have observed that the ability to blow out a candle successfully may not necessarily result in adequate speech. Kantner (*5*) noted that there seemed to be little carry-over into speech of the increased palatal efficiency achieved as a result of blowing exercises. He pointed to the need for ear training as a part of therapy. Others have recognized such an attack on articulation as important. Few have gone so far as to say with Brown and Oliver (*1*) and Harkins and Baker (*4*) that the correction of these misarticulated sounds would make the greatest change in speech. More recently, McDonald and Baker (7) speculated that certain deviations in placement and use of the tongue in these patients resulted in inability to produce many speech sounds. Therapeutic procedures developed from these observations stress articulation rather than the traditional direct attack upon velar-pharyngeal closure.

It is obvious that some conflict exists as to the best approach to the speech problems of cleft-palate patients. The study herein reported was an attempt to discover some of the components of intelligiblity of the speech of adults with cleft-palates. It was felt that information on this sub-

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ject might prove useful in determining therapeutic direction. The following questions were, therefore, posed:

1. Is there a relationship between the errors in consonant articulation found in a population of cleft-palate adults and the intelligibility of their speech?
2. Is there a relationship between errors in consonant articulation and ratings of nasality?
3. Is there a relationship between intelligibility and ratings of nasality?

Subjects

The subjects for this research were 48 cleft-palate patients between the ages of 17 and 59. The mean age of the group was 24.6, with the median falling at 22. They were a group of cleft-palate adults who were readily available to the experimenter. The subjects were obtained through three major sources—the Lancaster Cleft Palate Clinic at Lancaster, Pennsylvania; the Pittsburgh Cleft Palate Diagnostic Clinic, University of Pittsburgh; and from the private practice of Dr. Edward Armbrecht, oral surgeon, Wheeling, West Virginia. No attempt was made to control any variable such as amount and type of surgery, type of original cleft, orthodontic intervention, presence or absence of a speech aid, or attendance at a speech clinic.

Procedure

The 48 subjects each recorded on tape one of 12 lists of words, phrases, and short sentences developed from those originated by Dietze (*2*) and phonetically balanced in accordance with incidence of consonant sounds found in conversation by Travis (*9*). In short, the lists were designed in such a way as to include the 23 major consonant sounds in proportions comparable to the appearance of these sounds in conversation. Each of the subjects recorded also a short prose passage from the *Reader's Digest*.

When this recording procedure had been completed for all subjects, the experimenter undertook to analyze the consonant components in the recorded word lists for the purpose of determining the number and types of misarticulations. The examiner based judgments on what she perceived sound production to be as it was reproduced by the recorder. As a reliability check, it was decided to repeat the judgments on 10 of the test samples. On these 10, the experimenter agreed with herself in 90% of the sounds involved. There was an observable tendency to chart more errors when the records were heard for the second time. For this reason, all of the samples were evaluated and re-evaluated until the examiner felt that the best judgment possible had been made. This procedure was carried out prior to compilation of data on any other phases of the experiment in order to avoid biased judgments. When the articulation errors were scored, they were tallied; and each subject was assigned a score based upon the number of errors which he had on consonant sounds.

In order to determine the intelligibility of the speech of the 48 subjects participating in the study, three auditors listened to the recorded lists and wrote down what they understood each subject to say. It was recognized that these individuals would have to be people who could listen well and that it would be necessary to predetermine their listening capabilities. Therefore, these listeners were presented with a sample list of 30 items constructed of words appearing in the first of the 12 lists. This sample was read by the experimenter

and recorded on tape. Since the experimenter's speech can be considered normal, the listeners should have been able to understand most of what was said—even though the materials presented were made more difficult by there being few contextual clues to understanding. The auditors were instructed to write on judgment sheets exactly what they understood the speaker to say. These sheets were scored on the basis of the number of words misunderstood. The mean error was 1.33 words out of the 85 presented. This meant that only 1.5 per cent of the stimulus materials had been misunderstood and that, on the basis of this high level of listening accuracy, the three judges could justifiably participate in the study.

When the errors in understanding on the experimental samples had been tallied, the error score for each subject was divided by the number of words appearing in the selection read, thereby arriving at a percentage of words misunderstood for each of the participating subjects. This constituted the intelligibility score. Theoretically, the scores could have ranged from zero, representing perfect intelligibility, to 100, representing completely unintelligible speech.

The compilation of the intelligibility scores for each of the subjects made it possible to check the reliability of the three judges by comparing each one with each of the other two. The average of the intercorrelations among the three judges was .87.

The final evaluative procedure consisted of obtaining scale ratings of the nasality of subjects reading the prose passage. Seven listeners were presented with a standard sample, which was the recorded prose selection of the individual who fell at the mean on number of articulation errors. The listeners were instructed to consider this the mid-point of a five-point scale and to rate the remaining 47 subjects using the standard sample as a constant reference point. The reliability of the judges (by split-half technique to which the Spearman-Brown Prophecy Formula was applied) was .925.

Results

The correlation between the intelligibility and articulation scores was .715, which is significant beyond the one per cent level. This enables us to conclude that, as articulation errors increase, the cleft-palate patient suffers increasing difficulty in making himself understood.

When consonant articulation errors were correlated with nasality ratings, an r of .821, significant beyond the one per cent level, was obtained. This indicates that these two supposedly distinct characteristics of cleft-palate speech are, in reality, closely related and that any reduction in consonant errors results also in reduction in what listeners tend to call nasality.

The inter-relationship of .720 between intelligibility scores and nasality ratings suggested that nasality ratings had to a large extent been based upon the judges' ability to comprehend the speech of these patients. It pointed further to the fact that listeners find it difficult to divorce nasality from articulation errors and ease of understanding.

Conclusions

This study has shown that there is a positive relationship between the number of consonant articulation errors and the intelligibility of the speech of cleft-palate adults. It has also demonstrated that a positive relationship exists between consonant

articulation errors and ratings of nasality as well as between intelligibility and ratings of nasality.

Statistical results considered as a whole suggest that the cleft-palate patient has a speech deficit that is global in nature. If this is true, then we might expect that successful clinical attack in one area might result in change in speech behavior as a whole. We then must decide which of the components—articulation or nasality—we can best treat. Clinical experience has demonstrated that reduction in nasality cannot always be accomplished by attention to velar-pharyngeal closure. On the other hand, we have felt that improvement in over-all speech deficiency has often been achieved through initial attack on problems of articulation. This study tends to support that viewpoint. These findings lend support, too, to the views of Harkins and Baker (4) to the effect that correcting articulation errors would do more to improve the speech of these patients than any other technique presently available. In addition, the therapeutic approach suggested by McDonald and Baker (7) is indirectly supported.

These findings point to the possibility that in the past the importance of velar-pharyngeal closure as a first step in therapy has been over-emphasized. This study suggests that speech therapy might well begin with direct attention to articulation.

Summary

In an effort to investigate some of the components of intelligibility of speech of adult cleft-palate patients, 48 subjects recorded on tape speech samples which were evaluated by the experimenter for determination of number and type of articulation errors. A group of three judges wrote down what they understood these speakers to say, and each subject was assigned an intelligibility score based upon the judges' errors in understanding. Seven judges rated the speakers on nasality through the utilization of a five-point scale.

Correlations were run between intelligibility and articulation errors, intelligibility and nasality, and nasality and articulation errors. In every case, positive relationships were found to exist beyond the one per cent level of confidence. These findings were interpreted as lending support to the emerging practice of treating cleft-palate patients through a direct attack up articulation.

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7. McDonald, E. T. and H. K. Baker. Cleft palate speech: An integration of research and clinical observation. *JSHD*, 16, 1951, 9-20.
8. Moser, H. M. Diagnostic and clinical procedures in rhinolalia. *JSD*, 7, 1942, 1-4.
9. Travis, L. E. *Speech Pathology*. New York: D. Appleton-Century, 1931.

Book Reviews

VAN RIPER, CHARLES G. AND DOROTHY E. SMITH. *An Introduction to General American Phonetics*. New York: Harper & Brothers, 1954. Pp. 152. $2.50.

This book is essentially an exercise manual for learning to read and write English in IPA script. It contains 271 exercises, approximately two-thirds of which are training exercises and one-third testing exercises. Most of the material deals with speech sounds.

In treating the speech sounds, the authors emphasize the establishing of correct associations between the phonetic symbols and the sounds they represent. A good deal of ingenuity is shown in the exercises which were developed for training students to distinguish the sounds of English. Sometimes, however, the principle of learning by repetition is carried to extremes when exercises require writing and pronouncing simultaneously a single symbol for several lines and even a whole page.

Pedagogical devices are employed rather effectively. Material is presented in a simple-to-complex order, the sounds being presented first in isolation and later in combination with affixes, words, and sentences. Phonetic transcription is incorporated into the text from time to time, and a well-devised phonetic, cross-word puzzle is included. Acoustic and physiological descriptions of the sounds are provided, and are fairly complete and accurate. The test exercises are based upon the training exercises, and may be corrected by the instructor, or the students may check their own work against Kenyon and Knott's pronouncing dictionary which is followed in most of the exercises.

The presentation of the phoneme as merely a sound 'family' will probably trouble many who use this manual, because it is difficult to understand on the 'family' basis how speech sounds which 'sound' alike may belong to different phonemes, and some which 'sound' different may belong to the same phoneme. This reviewer believes that an explanation of the phoneme as a 'class' of sounds in terms of the criteria of physical similarity, contrastive and complementary distribution, and pattern congruity would have helped to clarify the phoneme concept which is so important for a basic understanding of language analysis.

The principles of phonetics, dialect geography, and pronunication standards are treated briefly in the final chapters. The format is attractive, the phonetic type is easy to read, and but one typographical error was noted. This manual should prove a helpful supplement in teaching students to use the phonetic alphabet.

ROBERT W. ALBRIGHT.
Cornell University

ROBINSON, HELEN M., ed. *Corrective Reading in Classroom and Clinic*. (Supplementary Educational Monograph, No. 79) Chicago: University of Chicago Press, 1953. Pp. 256. $3.50.

This monograph, the fifteenth and latest in the excellent series of reports of the proceedings of the annual University of Chicago reading conference, is the first of the series to be devoted primarily to a consideration of the problems of correction rather than developmental reading. The scope and nature of the content is most clearly and economically made apparent by an overview of the general organization of the component papers.

The first chapter, W. S. Gray's discussion of the world wide UNESCO study of reading, lends perspective but is otherwise not closely related to the theme of the volume. Robinson defines the theme and provides a general over-all frame of reference in the second chapter, *Problems in Corrective Reading in American Schools*.

The following six large aspects of the total problem of corrective reading are considered: indentifying the retarded reader; factors related to reading retardation; diagnosis; correction; materials and instruments; and books.

For each of these six problems an introductory paper presents the broad underlying principles, assumptions, basic criteria and issues. Following these, five papers are

Book Reviews is edited by Kenneth Scott Wood, University of Oregon.

devoted, one each, to specific applications at a specific level or in a specific situation: kindergarten through grade three; grades four through eight; high school; college; clinic.

Chapter IX consists of three clinical case studies, and both diagnosis and correction are illustrated. Chapter XVIII, *New Frontiers in Corrective Reading*, suggests future developments and provides a fitting capstone for the developed theme. A regular and very helpful feature of this series of monographs, a listing of noteworthy books for elementary grades, high school and junior college, is continued in the present volume in Chapter XVII.

This monograph should prove most stimulating and helpful to the classroom teacher, less challenging and useful to the reading clinician and of very limited value to the speech correctionist.

P. A. KILLGALLON.
University of Oregon

LECKY, PRESCOTT. *Self Consistency: A Theory of Personality*. New York: Island Press, 1951. Pp. 275. $4.00.

This book, edited and interpreted by Frederick C. Thorne, presents a theory of personality which evolved from the use of inventories and from clinical practice. Lecky noted eight areas of personality adjustment: 'social confidence, cooperation, optimism, family relations, sex attitudes, work attitudes, nervous symptoms and physical symptoms.' Scores on these seemed to increase or to decrease together. He developed the Individuality Record (reliability .937) with these eight areas as a basis.

Lecky theorizes that personality consists of four levels of integration: the biochemcial, physiological, psychological, and the sociological. Changes occurring at one level can cause changes at the other levels. Such events can result in changes within the individual's system of values and his ego.

The self-consistency theory, in essence, states that a person behaves in accordance with his system of values, and that changes in behavior must be preceded by changes in the value system. Although the term 'general semantics' is not used anywhere in the text, various examples used by the author would seem clearly to indicate that he would have been in full agreement with the general semantics approach. The poor speller is considered to be acting consistently with his concept of himself. The stutterer is also considered in the same light.

This book contains the Individuality Record which was developed by the author. It presents a highly interesting theory which has implications pertinent to speech pathology and communication in general. The book is highly recommended for those in the speech, English, and general communication areas.

JAMES H. PLATT.
Michigan State College

MCCAULEY, W. F. *The Concept of Schizophrenia*. New York: Philosophical Library, 1954. Pp. 145. $3.75.

This book estimates present knowledge of schizophrenia, assesses its historical background and evaluation, and indicates the importance of heredity and environment. It is based on a practical and bibliographical inquiry. The author's purpose is to provide a concise account of schizophrenia that may be of value to students preparing for examinations in psychological medicine and to those medical students who contemplate specializing in psychiatry.

TYLER, FRED T. *The Prediction of Student-Teaching Success from Personality Inventories*. Berkeley: University of California Press, 1954. Pp. 313. $1.25.

This is a research monograph which presents the results of a study of the prediction value for teaching success of the MMPI, the Heston Personal Adjustment Inventory, and the Johnson Temperament Analysis. These three inventories were given to three classes of students enrolled in the Secondary Education program.

The author concludes that his negative findings were due in part to the unreliability of his criteria of teaching success, and he states that 'there seems little justification for further prediction studies until the reliability of such criteria has been established.'

SARASON, SEYMOUR B. *The Clinical Interaction: With Special Reference to Rorschach*. New York: Harper and Brothers, 1954. Pp. 425. $5.00.

This book, prepared under the editorship of Gardner Murphy, is based on a course taught by the author at Yale University in which he advances the thesis that a subject's reaction to the Rorschach stimuli can be understood only in terms of the variables which are operative in all interpersonal interactions. These variables are described

in Part I of the book and are illustrated with examples taken from psychotherapy, psychodiagnosis, and social psychology.

Under the heading, *Situational Variables*, the book devotes eight chapters to overt and covert behavior, the nature of instructions and the purposes of the interaction, the stimulus task and the time and place of interaction, the psychologist as a variable, attitudinal factors related to previous learning, prediction and situational similarity, and continua for evaluating responses.

The second part of the book is devoted to the Rorschach Test in an attempt to demonstrate the relevance of the problems raised concerning situational variables. The author discusses the instructions for the test, location of response, color, and shading as external referents, movement as an internal factor, the plain form (F) response and form quality, the content of the response, and the psychologist. This is followed by what the author calls 'some major assumptions.'

The last 80 pages are given over to a presentation of six case protocols together with commentaries. The bibliography contains 188 references.

Current Trends in Information Theory. Pittsburgh: University of Pittsburgh Press, 1954. Pp. 188. $4.00.

This is a collection of seven papers presented at the seventh annual conference on Current Trends in Psychology at the University of Pittsburgh.

The papers are entitled *Mathematical Aspects of Information Theory* by Brockway McMillan; *Information Theory and the Discrimination of Sequences in Stimulus Events* by David Grant; *The Influence of Response Coding on Performance in Motor Tasks* by Paul Fitts; *Some Perceptual Problems from the Point of View of Information Theory* by Frederick Frick; *Information in the Head* by Warren McCullock; *Information Theory and the Study of Speech* by George Miller; and *Information Theory and Clinical Medicine (Psychiatry)* by Henry Brosin.

Ewing, Irene R. and A. W. G. Ewing. *Speech and the Deaf Child*. Washington, D. C.: The Volta Bureau, 1954. Pp. 256.

This book describes in detail a genetic approach to the teaching of speech to those who are deaf or who have partial impairment of hearing. The training and teaching of deaf children in nursery, infant, junior, and senior classes are discussed stage by stage. Particular attention is given to the potential function of speech in the mental life of deaf children.

The authors intended this book to be primarily of use to students and qualified teachers. They have traced the history of the teaching of speech to the deaf and have sought to clarify the relationship between earlier philosophies and their own methods.

The book discusses the needs of deaf children and methods of developing speech under chapter headings which include *Speech Readiness; Consonants in the Speech of Deaf Children; How to Become a Teacher of Speech; Rhythmic Training; Test of the Capacity of Children to Hear Speech; and Lipreading, Language, and Reading, the Forerunners of Articulation.*

Current Publications

Beranek, Leo L. *Acoustics*. New York: McGraw-Hill Book Co., 1954. Pp. 491. $9.00.

Betts, Emmet A. *Foundations of Reading Instruction: With Emphasis in Differentiated Guidance*. New York: American Book Co., 1954. Pp. 757. $6.00.

Bischof, L. J. *Intelligence: Statistical Conceptions of Its Nature*. New York: Doubleday and Co., 1954. Pp. 33. $0.85.

Bottrell, Harold R., ed. *Applied Principles of Educational Sociology*. Harrisburg, Pa.: Stackpole Co., 1954. Pp. 480. $4.50.

Crobaugh, Clyde. *Master List and Classification of Interjections*. Knoxville: C. Crobaugh, University of Tennessee, 1954. Pp. 32. $1.00.

Dubuisson, M. *Muscular Contraction*. Springfield, Ill.: Charles C. Thomas, 1954. Pp. 256. $6.50.

Eisenson, Jon. *Examining for Aphasia: A Manual for the Examination of Aphasia and Related Disturbances*. (Rev. ed.) New York: Psychological Corp., 1954. Pp. 78. $3.50.

Good, Carter V. and Douglas E. Scates. *Methods of Research, Educational, Psychological, and Sociological*. New York: Appleton-Century-Crofts Co., 1954. Pp. 940. $6.00.

GUILFORD, J. P. *Psychometric Methods.* (2nd ed.) New York: McGraw-Hill Book Co., 1954. Pp. 606. $8.50.

HODGSON, KENNETH W. *The Deaf and Their Problems: A Study in Special Education.* New York: The Philosophical Library, 1954. Pp. 364. $6.00.

HUDGINS, CLARENCE V. *The Response of Profoundly Deaf Children to Auditory Training.* Northampton, Mass.: Clarke School for the Deaf, 1954. Pp. 16. $0.50.

HUNT, FREDERICK V. *Electroacoustics: The Analysis of Transduction and Its Historical Background. Cambridge,* Mass.: Harvard University Press, 1954. Pp. 268. $6.00.

JOSEPH, HARRY AND GORDON ZERN. *The Emotional Problems of Children: A Guide for Parents.* New York: Crown Publishers, 1954. Pp. 319. $3.75.

Learning Theory, Personality Theory, and Clinical Research: The Kentucky Symposium. New York: John Wiley and Sons, 1954. Pp. 173. $3.50.

LEE, IRVING J. *Customs and Crises in Communication: Cases for the Study of Some Barriers and Breakdowns.* New York: Harper and Brothers, 1954. Pp. 334. $3.00.

LONGERICH, MARY C. AND JEAN BORDEAUX. *Aphasia Therapeutics.* New York: The Macmillan Co., 1954. Pp. 185. $3.75.

MILES, W. RICHARD. *Four Steps to Better Hearing.* San Francisco: Miles Publishing Co., 260 Kearny St., 1954. Pp. 77. $1.95.

MOSES, PAUL J. *The Voice of Neurosis.* New York: Grune and Stratton, 1954. Pp. 131. $4.00.

MURPHY, GRACE E. BARSTOW. *Your Deafness Is Not You.* New York: Harper and Brothers, 1954. Pp. 238. $3.00.

MCCAULEY, W. F. *The Concept of Schizophrenia.* New York: Philosophical Library, 1954. Pp. 313. $3.75.

PEI, MARIO A. AND FRANK GAYNOR. *A Dictionary of Linguistics.* New York: Philosophical Library, 1954. Pp. 238. $6.00.

PENFIELD, WILDER AND HERBERT JASPER. *Epilepsy and the Functional Anatomy of the Human Brain.* Boston: Little, Brown and Co., 1954. Pp. 896. $16.00.

ROBACK, A. A. *Destiny and Motivation in Language.* Cambridge, Mass.: Sci-Art Publishers, 1954. Pp. 474. $10.00.

ROGERS, CARL R. AND ROSALIND F. DYMOND, eds. *Psychotherapy and Personality Change: Coordinated Research Studies in the Client-Centered Approach.* Chicago: University of Chicago Press, 1954. Pp. 456. $6.00.

SCOTT, CECIL W. AND CLYDE M. HILL. *Public Education Under Criticism.* New York: Prentice-Hall, Inc., 1954. Pp. 428. $6.35.

TYLER, FRED T. *The Prediction of Student-Teaching Success from Personality Inventories.* Berkeley: University of California Press, 1954. Pp. 313. $1.25.

WOLSTEIN, BENJAMIN. *Transference: Its Meaning and Function in Psychoanalytic Therapy.* New York: Grune and Stratton, 1954. Pp. 206. $5.00.

Abstracts

MADISON, L. The use of hypnosis in the differential diagnosis of a speech disorder. *J. clin. exp. Hypnosis*, 2, 1954, 140-144.

The article discusses the case of an eight-year-old boy to illustrate use of hypnosis as an aid to differential diagnosis of a speech defect presenting aspects of both articulation difficulty and stuttering. Hypnosis can be a valuable technique in the diagnosis of speech cases presenting symptoms of several disorders, especially if one of them is stuttering. Hypnosis may be a valuable therapeutic method for treating many cases which present stuttering symptoms. (*H. McC.*).

ROSENBERG, S. AND J. CURTISS. The effect of stuttering on the behavior of the listener. *J. abnorm. soc. Psychol.*, 49, 1944, 355-361.

The effects of faked stuttering and normal speech were measured by two observers on 20 college students. It was found that eye contact was lost more and changed less with stutterers. Further, the listeners initiated fewer hand movements and body movements. The authors suggest that while there are differences in listener behavior, the complaints of stutterers concerning audience reactions may be justified. They also feel that the constricted behavior found in the listeners may be because stuttering is regarded as a noxious stimulus. (*V.B.C.*)

HARVOLD, E. Cleft lip and palate. *Amer. J. Orthodon. Oral Surg.*, 40, 1954, 493-495.

Studies of the morphology of patients having deformed facial skeletons resulted in the following conclusions: The major part of the deformities cannot be due to reduced growth potentials. The narrow dental arches may be attributed to a change in maxillary bone position and a concomitant inhibition of vertical alveolar growth. The abnormal tissues in the mid-section of the facial skeleton, which occur early in fetal life, have established an inconsistent pattern of growth and development. (*G.H.S.*)

SHARRY, J. J. The meatus obturator in cleft palate prosthesis. *Oral Surg., Oral Med., Oral Path.*, 7, 1954, 852-855.

In contrast to the 'fixed' or 'hinge' type obturator, the meatus obturator helps to eliminate many of the patients' personal variables which prove to be obstacles in getting the best speech results. The meatus obturator was formulated on the presumption that complete occlusion of the oropharynx from the nasopharynx was not necessary for good cleft palate speech. Two cases are presented in support of the effectiveness of this obturator in reducing nasal quality. (*G.H.S.*)

WALLIN, P. E. Rehabilitation of the oral cripple. *Ann. Dent.*, 13, 1954, 80-85.

In oral rehabilitation the specialties of prosthestics and surgery must work hand-in-hand for the best results. Each should be aware of the other's capabilities and limitations. An integrated program involving both fields would seem most beneficial. (*G.H.S.*)

AGRANOWITZ, A., R. BOONE, M. RUFF, G. SEAGAT AND L. TERR. Group therapy as a method of retraining aphasics. *Quart. J. Speech*, 40, 1954, 170-182.

The authors present a discussion of the value of using group therapy with aphasics

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Abstracts is edited by Jack Mathews, University of Pittsburgh, assisted by the following committee: Asa J. Berlin, Pennsylvania State University; Virginia B. Carroll, Minneapolis Veterans Hospital; Charles F. Diehl, University of Kentucky; James V. Frick, Pennsylvania State University; Inez Hegarty, Mt. Holyoke College; Lester L. Hale, University of Florida; Frank M. Lassman, University of Minnesota; Georgiana M. Peacher, Temple University; Sylvia O. Richardson, Boston Medical Center; George H. Shames, University of Pittsburgh; D. C. Spriestersbach, State University of Iowa; Jesse J. Villarreal, University of Texas. The committee systematically reviews 203 journals for articles of interest to members of ASHA.

with particulars concerning the structuring of groups and actual training procedures. It is based on the results obtained over a three-year period at the Aphasia Clinic of the Long Beach Veterans Administration Hospital, Long Beach, California. It was concluded that this type of retraining appears to have great value as an adjunct to individual therapy. (*C.F.D.*)

COURVILLE, C. B. The problem of cerebral palsy. *Bull. Los Angeles neurol. Soc.*, 18, 1953, 157-188.

General presentation of the problem of cerebral palsy, with emphasis on the physician's role in diagnosis, evaluation, and planning of appropriate therapy. After a summary of incidence, and a classification of etiology based on 1,254 cases, the author presents a discussion of applied anatomy and physiology of cerebral palsy. The discussion of pathology includes illustrations of various types of brain damage resulting in cerebral palsy. The components of a complete examination, including speech and hearing, are listed and briefly described. There is a lengthy bibliography. (*J.J.V.*)

COURVILLE, C. B., J. M. SANCHEZ-PEREZ AND E. M. AMYES. Prolonged survival after cerebral anoxia incident to nitrous oxide anesthesia. *Bull. Los Angeles neurol. Soc.*, 18, 1953, 136-140.

Report of a case, with 20-year follow-up, of a case of cerebral anoxia with resulting dementia, emotional disturbance, Parkinsonian syndrome, and aphasia. (*J.J.V.*)

HALPERN, L. Biological significance of head posture in unilateral disequilibrium. *Arch. Neurol. Psychiat.*, 72, 1954, 160-168.

The Magnus neck reflex influences both motor and sensory systems in cases of unilateral disequilibrium. Patients who change their head positions spontaneously were found to have demonstrable changes in visual and auditory perception as well as in stereognostic perception of size, which were in the direction of optimal compensation. (*J.M.*)

NIELSEN, J. M. Spontaneous recovery from aphasia: report of a case. *Bull. Los Angeles neurol. Soc.*, 18, 1953, 147-148.

Autopsy proof of spontaneous recovery from aphasia through the assumption of speech by the minor side of the brain is presented in the unusual case in which there was a loss of speech following lesion in left cerebral hemisphere, spontaneous recovery, later lesion in right cerebral hemisphere, and return of aphasia. Autopsy revealed lesions in both language areas, the left older. (*J.J.V.*)

PENFIELD, W. Mechanism of voluntary movement. *Brain*, 77, 1954, 1-17.

The author, from surgical observation, proposes that voluntary movement is derived from cortical areas functioning in relation to the underlying subcortical units. He reports the removal of the lower portion of the Rolandic motor strip in the dominant hemisphere without aphasia resulting, but with a residual severe anarthria or defective articulation. (*V.B.C.*)

THOMPSON, S. Orthopedic aspects of cerebral palsy. *J. except. Child.*, 20, 1954, 299-304.

The author describes the role of the orthopedist on the rehabilitation team and, also, how his function is correlated with those of the other specialists. (*J.V.F.*)

TROWBRIDGE, W. V. Unilateral agraphia without alexia. *Bull. Los Angeles neurol. Soc.*, 18, 1953, 153-155.

Report of rare case of loss of ability to write with preserved ability to read. Case was predominantly left-handed and learned to write with left hand. He was forced to relearn writing with right hand in school. After cerebral thrombosis, the case was no longer able to write with right hand; but was able without training to write accurately and legibly with left hand when he was encouraged to do so. Implications are explored regarding significance of the behavior of this case regarding transfer of function from one cerebral hemisphere to the other. (*J.J.V.*)

UNGER, D. An understanding basic to cerebral palsy. *J. except. Child.*, 20, 1954, 193-197.

The reactions and feelings of the parents of cerebral palsied children are stressed as being of the utmost importance in their own adjustment and in the rehabilitation of their child. (*J.V.F.*)

KLINE, M. V., H. GUZE AND A. D. HAGGERTY. An experimental study of the nature of hypnotic deafness: effects of delayed speech feed-back. *J. clin. exp. Hypnosis*, 2, 1954, 145-156.

The authors investigate the problem of hypnotically induced deafness with respect to its nature and consequent validity as related to effect on the organism. As an experimental procedure, auditory feed-back was used on a subject while hypnotized and while not hypnotized. Resulting stuttering and other speech difficulties occurring in the subject were used as a possible measuring stick of the validity of hypnotic deafness. (*H. McC.*)

ROACH, R. Considerations in education of children with various degrees of hearing loss. *J. except. Child.*, 20, 1954, 330-335, 358-359.

The author discusses the educational placement and measures needed by the child who, although given medical attention, still possesses impaired hearing. Such recommendations are categorized on the basis of the severity of the hearing impairment. (*J.V.F.*)

BENSON, R. W. The calibration and use of probe-tube microphones. *J. acoust. Soc. Amer.*, 25, 1953, 128-134.

Several probe-tube microphones with tubes of different sizes were calibrated for both free field and closed coupler purposes. It was necessary to seal the probe tube to the frame of the microphone with vaseline to prevent an acoustic leak reducing low frequency output. Pressure and free field calibrating of probe-tube microphones were shown to differ significantly. (*F.M.L.*)

HOUSE, A. S. AND G. FAIRBANKS. Influence of consonant environment upon the secondary acoustical characteristics of vowels. *J. acoust. Soc. Amer.*, 25, 1953, 105-114.

Seventy-two consonant-vowel-consonant syllables were spoken with the vowel preceded and followed by the same consonant. Vowels preceded and followed by voiced consonants were generally longer in duration, lower in fundamental frequency, and greater in relative power than when in unvoiced environments. Duration, frequency, and relative power of vowels also varied significantly with manner of production (stop-plosive, fricative, nasal) and somewhat less with place of articulation. The variations in duration and frequency seemed related to usual concepts of vowel physiology, while variations in relative power were atypical. (*F.M.L.*)

FAIRBANKS, G., W. L. EVERITT AND R. P. JAEGER. Method for time or frequency compression-expansion of speech. *Convention Record, Instit. of Radio Engin.*, 1953, 120-124.

The authors discuss the underlying theory and the method for time or frequency compression and expansion of speech and describe equipment used. The presentation at the convention included demonstration, by means of recordings, of compression and expansion of speech and music. Diagrams illuminate the discussion. (*F.M.L.*)

MILLER, R. L. Auditory tests with synthetic vowels. *J. acoust. Soc. Amer.*, 25, 1953, 114-121.

Vowel sounds were produced synthetically by a 100-component harmonic tone synthesizer and were presented to nine listeners who were asked to identify each sound as one of 11 steady state sounds. Fundamental frequency, formant frequency and amplitude, and number of formants were each varied independently and the effects on judgments of phonetic identity were studied. All parameters were shown to be important in the evaluations with pitch seeming especially significant. (*F.M.L.*)

CASSEL, R. N. Delineating the areas of educational and clinical psychology. *J. educ. Psychol.*, 45, 1954, 292-299.

In a discussion of the preventive role of the educational psychologist and the therapeutic role of the clinical psychologist, the writer lists the organization and direction of a speech clinic as one of the possible functions of a clinical psychologist. Co-operative diagnostic and therapeutic planning for aphasia and related problems and for other speech defects are included in the writer's outline. (*I.H.*)

News And Announcements

A new speech therapy service has been developed in the Department of Physical Medicine and Rehabilitation at the University of Minnesota Medical Center. The service is designed primarily for patients in the Rehabilitation Center of the University of Minnesota Hospitals, but also serves patients in other departments of the hospital. The speech therapy group is under the direction of Frank Lassman.

A series of 12 television programs on Your Child's Speech was presented weekly in Buffalo during the fall by Betty Gallagher, Associate Professor of Speech Correction and Head of the Speech Clinic at the State University of New York College for Teachers. Included in the series were discussions of the normal development of speech, children's speech defects, hearing problems and professional services available in the community for diagnosis and therapy. Each program reached an estimated audience of 45,000.

A formal protest, describing the current Selective Service policy toward scientists and engineers as contrary to law and detrimental to the true national interest, has been filed with Major General Lewis B. Hershey, Selective Service Director, by the American Chemical Society. The protest, in the form of a letter signed by Alden H. Emry, Executive Secretary of the Society, criticizes the 'apparent decreasing selectivity of Selective Service' and cites the handling of deferments for scientists, engineers, and other specialists as a disturbing case in point.

The University of Kentucky Speech and Hearing Center, Department of Psychology, opened its new Hearing Laboratory on October 15, 1954. The Laboratory program consists of clinical services, training and research and is being sponsored through a grant by the Lexington Council of Jewish Women and the Kentucky Society for Crippled Children.

Los Angeles State College has instituted a master of arts degree program in special education. Dr. Frances Lord has been appointed professor and coordinator of special education to expand and develop the program, which includes special work in speech correction.

At the spring meeting of the Washington State Speech Association in Seattle, President Fene Carlisle appointed a committee to organize a unit within its framework to be called The Washington State Speech and Hearing Therapists Association. Some regional units such as the Country Cousins and the Puget Sound Speech and Hearing Therapists have been active for several years and others are in the process of organization. A unique type of seminar was conducted during the past summer by the Puget Sound Speech and Hearing Therapists group. A three-day 'Coast Party Seminar' was held at a private lodge in the Washington woods with 25 therapists attending. Dr. Charles Van Riper previously led a seminar on stuttering and this past summer Dr. James E. Carrell gave an intensive three-day course on cleft palate. These seminars have become established as a tradition among the therapists of the State of Washington.

The speech clinicians of the Minneapolis Public Schools are working on a revision of *Speech in Practice*, a publication of the Minneapolis speech group.

The University of Nebraska Clinic has acquired additional space for its preschool and adult program through the remodeling of classrooms.

Karen Marie Bohn, Director of the Training School for Speech Correctionists in Oslo, Norway, who is visiting in the United

News and Announcements is edited by Charles R. Elliott, Northwestern University, assisted by the following committee: Jane Beasley, University of Alabama; George Gens, Newark (New Jersey) State Teachers College; Elise Hahn, University of California at Los Angeles; Earl Schubert, State University of Iowa.

States on the Fullbright Plan, spent six weeks at Rockford College this summer to study the summer speech center program for young children with cleft palate. Also from Norway is Ingrid Borrevik, who is pursuing advanced studies and assisting in the Speech Clinic at Rockford College.

Harvard University this fall started to train graduate students in the field of data processing. A specialized group has been selected as candidates for the new M.S. degree, the first such to be offered in the United States. Data processing involves the use of automatic computing machinery for problems where storage and handling of large amounts of information are required.

A relatively new plan of organization in clinical activities is the Organic Circuit at the Ohio State University. The three agencies supporting the activities are The Columbus State School (mentally deficient), United Cerebral Palsy Association (adult cerebral palsied), and The Elks (brain injured children). Six graduate students are supported to maintain the program.

The Audiology Foundation announces its list of scholarship grants for the current year as follows: Mary Rose Costello, Atlanta, Georgia; Philip E. Rosenberg, Baltimore, Md.; Jack A. Willeford, Evanston, Ill.; Albert W. Koch, Watertown, Mass.; Mrs. Daphne M. Bennett, England; Frederick Garbee, Lynchburg, Virginia; George Levine, College Park, Md.; Tony Cristopulos, Salt Lake City, Utah. All have been given $500 grants-in-aid to assist them in their study of audiology.

The Speech Department, Santa Barbara College of the University of California, has moved to a new ocean-front campus, nine miles west of Santa Barbara. Clinic offices, practice rooms, and other facilities have been markedly expanded.

Through a partial grant from the New Jersey Chapter of the National Society for Crippled Children and Adults, the Kessler Institute for Rehabilitation in West Orange has established a speech clinic. Betty Horwitz is the speech therapist and George Gens is consultant. Plans are under way for integrating speech therapy, occupational therapy and physio-therapy into a complete aphasic rehabilitation center. This will be the first such center for aphasics in the State of New Jersey. The Society has also established several new clinics in the state. The following cities have new clinics, and therapists as indicated, recently have been appointed: Albert Wychulis at Atlantic City, Cynthia Faigle at Somerville, Harriet Levinson at Orange.

A unique plan for providing funds for speech correction has been put into practice by Minter L. Wilson, long time supporter of work for crippled children, of Morgantown, W. Va. He has announced that a 15% royalty on his latest book, *The Happy Years*, has been allotted to the West Virginia Society for Crippled Children and Adults for use in expanding the Society's speech program throughout the state. Judge Wilson gave the first 200 copies of his book and full proceeds from them to his local society, the Monongalia County Society at Morgantown. A summer speech center at West Virginia University was set up with proceeds from the funds.

Zeta Tau Alpha and the National Society for Crippled Children are joining forces in a new project to help parents of cerebral palsied children. The development of an extensive program and materials involving visual aids for parent education in cerebral palsy is seen as providing a new broad attack on the many problems such parents face.

A new graduate course in semantics will be offered in the spring by Queens College, taught by Dr. John B. Newman of the speech department. This may be of special interest to speech correctionists in the area as such a course is allowable for certification of some areas under ASHA.

New facilities consisting of a diagnostic room and a parent's room has been added to the speech clinic at Marquette University in Milwaukee. In addition, 10 new individual therapy booths will be shared with the psychology department. Two-way mirrors provide observation of the clinic activities by students and parents.

The Speech Clinic of Marquette University will conduct speech therapy in school clinics established in Catholic, Lutheran and Hebrew elementary schools and academies. Sixteen school centers will be served. The

Hearing Laboratory of Marquette University will conduct a hearing program in the parochial schools for the Milwaukee Health Department. Children found in need will be referred to the city health officials for an otological follow-up.

A greatly expanded program to provide speech correction services for children in Allegheny County and the seven surrounding counties began in the fall at the University of Pittsburgh under a grant of $76,000 for a three-year program from the Pittsburgh chapter of the United Cerebral Palsy Association. An additional grant of $10,000 has been made to remodel existing space on the eleventh floor of the Cathedral of Learning to house the expanded program.

The Fund for the Advancement of Education, established by the Ford Foundation, has announced the granting of 236 one-year fellowships to college and university faculty members in this country and Hawaii. The grants, which are valued at more than $1.3 million, are designed primarily to enable the recipients to become better qualified to teach in their respective fields, which include the humanities, the social sciences and the natural sciences.

A total of 27 fellowships, each worth $2000 to $3500, is being offered by the American Association of University Women for the academic year 1955-56. The awards, most of which are unrestricted as to subject and place of study, are for women who are completing work on their Ph.D. degrees or who already have them, and for mature scholars. For details write the Secretary, Committee on Fellowship Awards, American Association of University Women, 1634 I Street, N.W., Washington 6, D. C.

The University of Illinois Speech Clinic has added to its six-week school internships a training program in cerebral palsy at Lake View Hospital, Danville, Illinois, under the supervision of Dr. Marie Shere.

Under the auspices of the Western Society for Rehabilitation the first training program for speech correction in Canada was instituted in September, 1954 at the University of British Columbia, Vancouver, Canada. The planned course of training involves five years of study and leads to a diploma in Logopedics from the U.B.C. Faculty of Medicine in addition to a B.A. Mr. A. B. Clemons, formerly of the University of Witswatersrand Speech and Hearing Clinic, Johannesburg, South Africa, is in charge of the program.

The University of Southern California Speech and Hearing Clinic and the Hearing Center of Metropolitan Los Angeles developed and presented a series of 10 weekly UHF Telecasts entitled 'Bring Them Back to the Hearing World.' This was an experimental series designed to test the feasibility of presenting lip-reading lessons to the TV audience. The half-hour programs consisted of a 15-minute lip-reading lesson and 15 minutes of discussion by prominent people in the oto-audiological-speech fields.

The University of Southern California Department of Speech has effected a liaison with the VA Hospital (Wadsworth) in Brentwood (Los Angeles) and is offering courses and clinical experience in language retraining therapy for aphasics. Mr. Maurice Sklar, Chief Language Retraining Therapist (Wadsworth) and lecturer at USC is teaching the course. Four students were recipients of special scholarships jointly given by USC and the John Tracy Clinic for the new complete training course in teaching preschool deaf children. Dr. Boris Morkovin, Professor Emeritus of Speech, USC, Mrs. Lucelia Moore, Lecturer in Hearing and Education and Consultant to the Metropolitan Hearing Center of Los Angeles, and the parents of deaf children in the Los Angeles area have started a unique program, 'Life Workshop,' on the campus of USC. The program is designed for teen-age deaf youth and their parents. Parent discussion groups, activity therapy, music and recreation are only a few of the aspects of this program. The University has made available and renovated a residence at 944 W. 37th St. for their use. The Pilot Club of Los Angeles has adopted the workshop as its chief philanthropy. Dr. Wm. Perkins, USC Speech and Hearing Clinic Supervisor of Clinical Training, has initiated a program of activity therapy for preadolescent stutterers. The Stancil-Hoffman and Westrex Corporations recently donated a $2000 piece of equipment to the Speech and Hearing Clinic at USC for audiological research.

Dr. Edgar Lowell, formerly Assistant Professor in Educational Psychology, Har-

vard University, has been appointed Administrator of the John Tracy Clinic in Los Angeles.

Louisiana has recently set up its first area speech and hearing program in the public schools with Charles Campbell of Baton Rouge appointed as Regional Consultant. Mr. Campbell has been added to the staff of the Special Education Clinic of Southeastern State College in Hammond. The new project is designed not only to coordinate the work of speech and hearing rehabilitation in this unit of parishes, but also to provide opportunities for newly-graduated therapists to do a year of 'externship' under qualified supervision. It is expected to serve as a pattern for other regional programs throughout the state.

The Hawaii Cancer Society has cooperated with the University of Hawaii in establishing a program for the rehabilitation of laryngectomized cases at the Speech Clinic. A program has been developed at the University of Hawaii whereby classroom teachers may receive, in conjunction with their fifth-year certificate, training that will permit them to serve as speech and hearing therapists in their respective schools. The plan makes it possible for prospective teachers to get their training by using the electives set up in their regular five-year programs and to work in some of their clinical hours while they are practice teaching. Mrs. Mary J. Webster has secured a grant for the establishment of a reading clinic in conjunction with the University of Hawaii Speech Clinic.

Free hearing tests to the public were a unique service offered at the Mahoning County Fair and in Youngstown during Hearing Week by the staff of the Hearing and Speech Center and the public school correctionist staff of Youngstown, Ohio. The project was conducted with the approval and cooperation of the county medical society.

The Chicago Speech Therapy and Audiology Society has issued a general invitation to groups in its area to supply teams of professional speakers to present and interpret the work of the speech and hearing professions. A panel or single speaker will be provided and a program designed to fit the needs of particular groups will be offered without charge. This is part of a campaign to acquaint the public with the services and responsibilities of the professions of speech therapy and audiology.

The University of Missouri Speech and Hearing Clinic scheduled five off-campus clinics this fall and conducted a clinic at Jefferson City for cerebral palsied in conjunction with the program sponsored by United Cerebral Palsy there.

The Speech Correction Department of Southern Illinois University has recently joined with the Southern Illinois Association for the Crippled to offer a new service to the area. This new clinic is known as the Therapy Center and is in addition to the already existing Speech Clinic. The new center provides out-patient services for all types of speech and hearing disorders found in the Southern 32 counties of the state. Plans call for the extension of the Center Services to other needs of the crippled in the near future. Southern Illinois University Speech and Hearing Clinic is also expanding its services for the deaf and hard of hearing. Complete audiometric and speech reception testing equipment has been installed and a program of testing initiated. As a part of this program an adult evening program for hard of hearing and deaf is being conducted.

The Junior League School for Speech Correction of Atlanta, Georgia has just completed a new clinic wing consisting of five testing rooms. The rooms will also provide additional teaching facilities for graduate students.

The University of Michigan has recently completed the remodeling of a house to provide room and board facilities for dysphasic clients of the University Speech Clinic. The house will accommodate 12 men at 1034 E. Huron St., directly across the street from the clinic. The dysphasic program is organized on the basis of a twelve-week program of therapy, five hours per day, five days per week of speech and language instruction. Last May the University established a Speech Correction Service in the Out-patient Clinic of the University Hospital. The rooms were equipped through funds from the University Medical School.

The University of Georgia has developed a full time offering in undergraduate and

graduate speech correction curricula. A building is in the process of being remodeled to house the Speech and Hearing Clinic, the Program for Exceptional Children, and the Children's Reading Clinic.

Meetings Announced

American Speech and Hearing Association, November 17-19, Hotel Statler, Los Angeles, California.

Speech Association of America, week of December 26, 1955, Hotel Statler, Los Angeles.

American Psychological Association, September 2-7, 1955, San Francisco.

Regional Speech meetings: Eastern, March 31-April 2, 1955, Hotel Statler, New York. Southern, April 4-9, Memphis, Tennessee. Central, April 1-2, Hotel Jefferson, St. Louis.

Temple University Annual Reading Institute, January 24-28, Temple University Reading Clinic, Philadelphia, Pennsylvania.

Texas State College for Women Third Annual Speech Correction-Special Education Conference, February 11-12, Texas State College for Women Campus, Denton, Texas.

New Materials

A new film, 'The Wisconsin Cleft Palate Story,' 36 minutes in sound and color, is available on the rental basis from the Bureau of Visual Instruction, University of Wisconsin Extension Division, 1328 W. Johnson St., Madison, Wisconsin. Purchase may also be had.

A catalog of tapes for education and entertainment has been issued by Swenson's Tape and Recorder Service, 320 S. Front St., Mankato, Minnesota.

American Standard Letter Symbols for Acoustics Y10.11—1953 is now available from the American Standards Association, 70 East 45th St., New York 17, N. Y. at $1.00 per copy. Preferred symbols are provided for some 200 terms used in acoustics. The standard was drafted by a dozen well known members of the Acoustical Society, with Dr. H. F. Olson as Chairman of the Subcommittee.

A new edition of *Psychological Cinema Register*, a 72-page annotated list of 16 mm. instructional and documentary films in general areas of psychiatry and psychology is available from the Audio-Visual Department of Pennsylvania State University, State College, Pennsylvania.

The Ninth Annual (1955) edition of *Annotated List of Books for Supplementary Reading* (kindergarten-9th grade) is available from Childrens Reading Service, 1078 St. John's Place, Brooklyn 13, New York.

Copies of the Department of Defense Symposium on Magnetic Recording (held October 12-14, 1953) are available to companies and individuals who are actively engaged in development, manufacture, or technical application of magnetic recording equipment. Requests, with some information of the 'need to know' type, should be addressed to: Armed Services Technical Information Agency, Document Service Center, Knott Bldg., Dayton 2, Ohio.

A publication containing selected papers from the second National Conference on Rehabilitation Centers is available from the Office of Vocational Rehabilitation, Washington 5, D. C.

University Microfilms, Ann Arbor, Michigan, has available a new release: Malone, S.S.J., An Analysis and Evaluation of Phonemic Differences in the Speech of Boys and Girls at the Kindergarten, First, Second, and Third Grade Levels, Ph.D. Thesis, U. of Mich., 1954, 279 pp., $3.45 for microfilm, publication No. 8379.

Brochures describing the clinic services available have been received from: Stanford University Speech and Hearing Clinic, Stanford University, Stanford, California; Junior League School for Speech Correction, 2020 Peachtree Rd., Atlanta, Georgia.

The Revision of Public School Speech Correction is a brief publication on the 'block system' revision of speech correction, by Dr. Charles Van Riper, Director, Speech Clinic, Western Michigan College of Education, Kalamazoo, Michigan.

How Children Can Be Creative, Place of Subject Series. This Bulletin is organized around questions which arise in making

opportunities for creative expression available to children. 1954, 23 pp., 15 cents. Government Printing Office, Supt. of Documents, Washington, D. C. Catalog #FS 5.3: 954/12.

Motion Pictures on Child Life, Supplement No. 1. 16 mm. films for adults on what can be done for children. Full description of each film listed is given. 16 pp., 15 cents, Supt. of Documents, Washington, D. C., Catalog #FS 3.202:M 85/2/supp. 1.

Proceedings of the last three Annual Noise Abatement Symposia, held at the Armour Research Foundation, Chicago, are available from the National Noise Abatement Council, 36 W. 46th St., N. Y. 36, N. Y., at $1.00 each. The proceedings include the text of papers presented covering the general subject of industrial, office, traffic, airplane, and airport noises; methods of measuring noise, and other aspects of noise problems including the effects of noise on health and methods of noise control.

Graduate Assistantships, Fellowships and Scholarships

This section, an annual feature of the December issue, lists part-time graduate appointments, fellowships, and scholarships specifically designated for graduate work in speech and hearing. General university fellowships and scholarships, unspecified as to area of concentration, and full time graduate positions will not be included. Only those announcements received too late for the December issue are printed in other issues.

Copy should be submitted to the News and Announcements Editor, and should include formal title of appointment, institution, and unit; dates, general duties, and remuneration; name and address of persons receiving application. Deadline for receiving copy is two months prior to the publication date.

Assistantships. Boston University. Speech and Hearing Center. Remission of $600 tuition for full-time graduate study. Diagnosis and therapy. Address Wilbert L. Pronovost, Speech and Hearing Center, Boston University, Boston, Massachusetts.

Assistantships. Temple University. Limited number available for qualified students with an undergraduate major or minor in speech correction. Stipend is $900 for nine months with waiver of tuition fee. Nine hours of graduate credit may be earned each semester. Graduate assistants give 20 hours weekly in diagnostic, therapeutic and supervisory services in the Speech and Hearing Clinic. Graduate program is planned to give students advanced training in all aspects of speech and hearing problems leading to Master of Arts or Master of Education Degree. Address Gordon F. Hostettler, Department of Speech and Dramatic Arts, Temple University, Philadelphia 22, Pennsylvania.

Clinical Assistantship. University of Nebraska. Speech and Hearing Laboratories. Starting in September, 1954. Twelve to 15 hours per week. $900 plus remission of tuition. Address Leroy T. Laase, Speech Department, University of Nebraska, Lincoln, Nebraska.

Clinical Assistantships. Pennsylvania State University. Speech and Hearing Clinic. Starting February or September. Half-time; 20 hours per week. Clinical work with adult vocational rehabilitation clients or college students. $1180 for 10 months; remission of tuition. Students expected to enroll for half-time graduate course load, 8 to 10 credits per semester. Quarter-time and three-quarter time assistantships are available. Address Eugene T. McDonald, Speech and Hearing Clinic, Pennsylvania State University, State College, Pennsylvania.

Clinical Assistantships. Purdue University. Speech and Hearing Clinic. Starting February or September. Half-time. 20 hours per week of clinical assistance. $1500 for regular school year; waiver of tuition. May enroll for 10 hours of graduate credit. Address M. D. Steer, Speech and Hearing Clinic, Purdue University, West Lafayette, Indiana.

Clinical Assistantships. Stanford University. Speech and Hearing Clinic. Ten to 20 hours per week. $750 to $1800 per school year depending on hours worked and type of position. Additional remuneration for summer term. General clinical work in speech and hearing or specialized work with cerebral palsied children. Two half-time positions available in affiliated medical clinics nearby. Reduced tuition for holders of assistantships. Address Virgil A. Anderson, Speech and Hearing Clinic, Stanford University, California.

Clinical Assistantships. Syracuse University. The Gordon D. Hoople Hearing and Speech Center. Twenty hours per week. $1200 to $1500 plus six hours tuition remission per semester. Address Louis M. Di Carlo, The Gordon D. Hoople Hearing and Speech Center, 805 Crouse Avenue, Syracuse 10, New York.

Clinical Assistantships. University of Alabama. Department of Speech, Speech and Hearing Clinic. Starting February or September. Half-time; 20 hours per week of clinical assistance. $1,000 for regular school year; waiver of out-of-state tuition. Students may carry three-fourths normal graduate load. Address T. Earle Johnson, Department of Speech, Box 2025, University of Alabama.

Clinical Assistantships. University of Michigan. Speech Clinic. Approximately 13 clinical assistantships for graduate students for the fall and spring semesters of academic year and summer session. Clinical service in one of the six service divisions of the Clinic: the Examining Division, Hearing Division, Children's Division, Adult Division, Adult Dysphasia Division, and the Student Division. Qualified graduate students may carry up to 10 hours of work per semester along with the 20-hour assistantship. $575 per semester for graduate students at the Master's level, first year Doctoral candidates $625 per semester, second year Doctoral candidates $700 per semester, third year Doctoral candidates $750 per semester. Summer Session remuneration rates one-half of these amounts. The supervisorship of the Student Division carries a stipend of $1,800 per academic year on the basis of a half-time appointment. Address Harlan Bloomer, Speech Clinic, University of Michigan, Ann Arbor, Michigan.

Clinical Assistantships. University of Minnesota. Audiology Clinic, University Hospital. Starting June, September, January, March. Half-time, $1310 for 11 months. Remission of half tuition. Reduced course load. Address Frank M. Lassman, University Hospital, University of Minnesota, Minneapolis 14, Minnesota.

Clinical Assistantships. Western Reserve University (Granted by the Cleveland Hearing and Speech Center). Assistantships available in speech and hearing therapy, audiology and education of preschool hearing handicapped. Appointments for calendar year include 10 hours tuition exemption each semester and three hours of tuition exemption for each of two summer terms and stipend of $1200 to $1500. Applications must be received by May 1, 1955. Address applications to Director of Admission, Western Reserve University, Cleveland 6. For further information write: Cleveland Hearing and Speech Center, 11206 Euclid Ave., Cleveland 6, Ohio.

Clinical Assistantship for Summer. Stanford University. Special school for cerebral palsied children nearby. Half-time work as speech therapist. $400 for six-weeks session. Part-time graduate work in Stanford eight-weeks summer session expected. Reduced tuition. Address Virgil A. Anderson, Speech and Hearing Clinic, Stanford University, California.

Clinical and Research Assistantships. Northwestern University. Hearing Clinic and Audiological Laboratories, Department of Speech Correction and Audiology. Starting September part-time; salary determined by type and amount of work. Up to $1,150 for regular school year plus summer appointment when indicated. Student may enroll for 10 quarter hours of graduate courses. Address Raymond Carhart, School of Speech, Evanston, Illinois.

Clinical and Research Assistantships. Northwestern University. Speech Clinic. Department of Speech Correction and Audiology. Starts September, part-time, remuneration depends on hours and duties, up to 12 hours per week, up to $900 plus half-tuition for regular school year. May take 10 hours graduate work. Address Harold Westlake, School of Speech, Northwestern University, Evanston, Illinois.

Clinical and Research Assistantships. University of Pittsburgh. University Clinics and Hospital speech and hearing facilities affiliated with University. Stipend $1,278 for nine-month school term plus remission of tuition and fees. Good chance for renewal during summer months at same rate. Assistants may carry three quarters graduate load leading to M.S. or Ph.D. in speech and hearing disorders or psychology. Write Jack Matthews, Speech Clinic, University of Pittsburgh, Pittsburgh 13, Pennsylvania.

Fellowships. Boston University. Speech and Hearing Center. $1,200 plus remission of tuition for 2/3 graduate load. Address Wilbert L. Pronovost, Speech and Hearing Center, Boston University, Boston, Mass.

Fellowships. State University of Iowa. Speech pathology and audiology. Half-time; 20 hours per week. $100 per month for 11 months; remission of tuition. Fellows allowed to carry 12 semester hours of course work. Applications received any time; must be received by July 1, 1955 to be considered for 1955-56 academic year. Address Wendell Johnson, Speech Clinic, State University of Iowa, Iowa City, Iowa.

Fellowships. University of Wichita (employment in the Institute of Logopedics). Duties primarily clinical. $200 to $250 per month; student expected to pursue course work toward the M.A. degree. Address Martin F. Palmer, Institute of Logopedics, 2400 Jardine Drive, Wichita 14, Kansas.

Graduate Assistantships. University of Denver School of Speech, Children's Speech Clinic. Grant from the Junior League of Denver, $200 per quarter, starting Fall, 1954. Students can carry 12 to 15 hours, working towards degrees in Speech Pathology and Audiology. Prefer that they have had some graduate work in these areas. Address Ruth M. Clark, Children's Speech Clinic, University of Denver, Denver 10, Colorado.

Graduate Scholarships. Emory University and Junior League School for Speech Correction. Scholarships cover full tuition for 4-5 quarter graduate program in speech and hearing. Grants $700-$875. Applications must be received prior to February 15. Address Claude S. Hayes, Junior League School for Speech Correction, 2020 Peachtree Road, Atlanta, Georgia.

Grants-in-aid. The Audiology Foundation. Three types offered: scholarships, research grants, publication grants, to students already engaged in any branch of audiology or students wishing to enter the field. $500. Applications must originate with educational sponsors. Assurance that the student will continue to work in audiology is necessary. Address The Audiology Foundation, Box 21, Glenview, Illinois.

Internships. University of Michigan Speech Improvement Camp, Shady Trails. Nine weeks starting June 20, 1955. Clinical work and graduate study at the camp at Northport, Michigan. Six semester hours of graduate credit. Camp provides tuition, room, board and partial remuneration of travel and other personal expenses. Address John N. Clancy, University of Michigan Speech Clinic, 1007 East Huron St., Ann Arbor, Michigan.

Research Assistantship. Western Reserve University (Granted in cooperation with the Cleveland Hearing and Speech Center). Assistantship available to conduct research in speech therapy or audiology. Appointment for nine months carries maximum tuition exemption of 10 hours per semester and stipend of $800. Applications must be received by March 1, 1955. Address applications to Director of Admission, Western Reserve University, Cleveland 6. For further information write: Cleveland Hearing and Speech Center, 11206 Euclid Ave., Cleveland 6, Ohio.

Research Assistantships. Purdue University. The Voice Science Laboratory, Department of Speech. Starting February or September. Half-time, 20 hours per week of laboratory assistance. $1,500 for regular school year; waiver of tuition. May take 10 semester hours. Address M. D. Steer, Voice Science Laboratory, Department of Speech, Purdue University, West Lafayette, Indiana.

Scholarship. Stanford University. Speech and Hearing Clinic. Available to student majoring in audiology. Approximately $750. No duties. Address Virgil A. Anderson, Speech and Hearing Clinic, Stanford University, California.

Teaching Assistantships. Stanford University. Department of Speech and Drama. Starting September. Three to six hours teaching plus some conference work per week. Up to $900 depending upon load carried. Reduced tuition. Basic voice and diction or English for foreign students. Address Virgil A. Anderson, Speech and Hearing Clinic, Stanford University, Calif.

Technical Assistantships. University of Alabama. Department of Speech, Hearing Clinic and Recording Laboratory. Starting February or September. Part-time; hours from five to 20 per week; salary determined by type and amount of work. Up to $1,000; waiver of out-of-state tuition. Address T.

Earle Johnson, Department of Speech, Box 2025, University of Alabama.

Training Fellowships. Vanderbilt University School of Medicine. Starting September. Programs leading to M.S. in speech correction or audiology. $1,800-$2,000 for 12 months. Address Forrest M. Hull, The Bill Wilkerson Hearing and Speech Center, Vanderbilt University School of Medicine, Nashville, Tennessee.

Working Scholarships. Western Reserve University (Granted by the Cleveland Hearing and Speech Center). Daniel Dauby Memorial Scholarship in speech and hearing therapy awarded with remuneration and working time arranged according to demands for clinical service and needs of student. Address applications to Director of Admission, Western Reserve University, Cleveland 6, Ohio.

News About People

Paul C. Moore has been appointed as Instructor and Miss E. Aleen Hunt as Supervisor at the Speech and Hearing Center of the University of Utah.

Dorothy Sherman is directing research at Ohio State University during John Black's absence for a year in Italy under a Fulbright Research Fellowship. Ruth Beckey Irwin has been advanced to the rank of Associate Professor of Speech.

Merle Ansberry has been appointed Chairman of the Staff of the Speech Clinic at the University of Hawaii.

Richard M. Boehmler has accepted a position as Assistant Professor of Speech at Humboldt State Teachers College, Humboldt, California.

Carolyn Gustafson has been appointed Chief Speech Therapist, United Cerebral Palsy, Baton Rouge, Louisiana.

Oliver M. Skalbeck has joined the staff at the State University of Iowa.

Jess Barton has joined the Tennessee Department of Health as Speech Consultant for several northeastern counties in Tennessee.

Mary Lucy Betts has been appointed Speech Correctionist with the Houston Independent School District, Houston, Texas.

John Crawford has been appointed Assistant Professor of Speech at the College of the Pacific, in the area of speech pathology.

Martin Schultz has been appointed Instructor in the Department of Speech Correction and Audiology at Northwestern University. Mrs. Florence Lightfoot has been appointed Supervisor of Practice Teaching in Speech Correction at Northwestern University. Paul G. Moore has been appointed Director of Clinical Speech at the Voice Clinic of the Northwestern University Medical School. Donald Counihan has been appointed Director of the Cleft Palate Institute of the Northwestern University Medical School.

Eugene Batza has been appointed Assistant Professor in Speech Correction at Bowling Green University in Ohio.

The Seattle Public Schools announce the following appointments to their staff in Hearing and Speech therapy: John Selmar, Karen Wangsness, Florence Poorman, Marian McWilliams.

Georgia Dandos has been appointed as teacher in charge of the preschool clinic at the The Speech and Hearing Laboratories of the University of Nebraska. John McGee has been transferred from the extension division to the Speech Clinic.

The Division of Speech Correction of the Chicago Public Schools has added the following to its staff this year: Libby Adler, Don Bailey, Jack Bloom, Dale Goldberg, Raphael Haller, Jean Kark, Theresa Lawsche, Carolyn McLean McBee, Rhoda Brown Oif, Edward F. Romans, Dawn Rosset Schuman, Jean Sladek, Phyllis Treadway, Rosemary M. Vanderah, Edith Kinney Ward.

Sary K. Wischner has joined the staff of the Silver Spring Intermediate School, Montgomery County, Maryland as speech therapist.

Francis Kodman, Jr. has been appointed Assistant Director of The Speech and Hearing Center, Department of Psychology, University of Kentucky. Faye Cagle has joined

the staff at the Speech and Hearing Center at the University of Kentucky, in charge of the Out Patient Clinic.

Bernice Laws Tuell has been appointed Supervisor of Cadet Teachers in Speech Correction at Bradley University.

Frances Brown and Florence Wertz have joined the speech correction staff, and Harriet Silver the staff of Agazzie School for the Deaf and Hard of Hearing, of the Department of Special Education of the Minneapolis Public Schools.

Louis Lerea has joined the staff of Northern Illinois State Teachers College as Assistant Professor in Speech and Speech Correction.

Irene Cherhavy Shumak has been appointed Speech Correctionist for the Public Schools of Park Forest, Illinois.

Carmen C. Dixon has joined the staff of the Chula Vista, California, City Schools as Speech and Hearing Consultant.

Hallak McCord has been named Director of Education at Laradon Hall, school for exceptional children in Denver. He will continue in his position at the University of Colorado, Denver Extension Center.

Gertrude Eggert, Maryanna Bender and Clark Staff have joined the clinical staff in speech correction at the Rehabilitation Center of the University of Minnesota.

Gladys Drake has been appointed as a consultant to teach language for the deaf at Texas State College for Women. Ruth Orenbaum has joined the staff as consultant to teach speech for the deaf.

J. Dale Welsch has been appointed Director of the Chattanooga-Hamilton County Speech and Hearing Center in Tennessee.

Jane Beasley, on leave from the University of Alabama, has accepted a part-time appointment at the Queens College Speech and Hearing Clinic and will participate in the Extension Division of the Newark, New Jersey, State Teachers College. Hubert Rubin has returned to his position on the staff of the Queens College Speech and Hearing Clinic. Edward Shulman has joined the faculty of the Extension Division of the Newark State Teachers College.

Lennert Kopra has been appointed Assistant Professor in the Department of Speech at the University of Texas to develop the audiological program at Austin. James Jerger has been appointed full-time Research Assistant on the staff at Northwestern University which is conducting research on Auditory Efficiency in Noise for the U. S. Air Force.

Herscel W. Misonger has succeeded Thomas L. Tolan as President of the American Hearing Society.

Appointments of recent Pennsylvania State University graduates are as follows: Janina Krantz, Speech Pathologist, Indiana University Medical Center, Indianapolis; Rolland Van Hattum, Speech and Hearing Supervisor, Rochester, N. Y., Public Schools; Malin Martin, Speech Therapist, Wyoming Valley Crippled Childrens Society, Wilkes-Barre, Pa.; William Mullen, Audiologist, Rhode Island School for the Deaf; William Dopheide, Speech Therapist, Public Schools, North Collins, N. Y.; Constance Lyons, Hearing Therapist, Erie Public Schools, Pa.; Milton Hill, Consultant in Speech Correction, Topeka, Kansas; Clifford Grine, Speech Therapist, Sharon Public Schools, Pa.; Samuel Shilling, Speech Therapist, New Castle Public Schools, Pa.; James McDonald, Speech Therapist, Blair County Society for Crippled Children and Adults, Altoona, Pa.

Stacea Pleva has been appointed as audioligist, and Iva Rogers Black as speech correctionist, at St. Luke's Hospital in Chicago.

Milton Eastman has been appointed as full time consultant for the program in Speech and Hearing in the State of Illinois.

Ruth Curtis has joined the speech correction staff of the Grosse Point, Michigan, Public Schools.

Tulane University School of Medicine has added the following staff members: Maurice Joseph, audiologist; Pauline Joseph, teacher for preschool deaf.

Josephine Simonson has returned from a Fullbright Fellowship in Egypt last year, where she advised on the establishment of speech and hearing rehabilitation centers, and has joined the staff of the University of Connecticut.

George Falconer has been appointed to assist in the development of the Magnolia Speech and Hearing Foundation and Treatment Center and the Childrens Rehabilitation Center at Jackson, Mississippi.

Loyal Bearss has been appointed Director of the Speech and Hearing Clinic at Mississippi Southern University.

Marian L. Gilmore has joined the staff of the Cleveland Hearing and Speech Center to supervise the Center's program for cleft palate children and to represent the Center on the cleft palate team recently established at Mt. Sinai Hospital. Frank Frueh has joined the Center staff as a clinical audiologist.

Sally L. Casey is now Supervising Teacher of Special Education in a new Special Education Program under the auspices of the Colorado State College of Education and the Greeley Public Schools.

Charles Lee Hutton has been appointed to the faculty of Louisiana State University to develop the hearing program in connection with the speech clinic.

John Miller has been appointed Director of the newly established program in cerebral palsy at Monroe, La.

Elaine Washington has joined the staff of the West Tennessee Hearing and Speech Center of the Tennessee Hearing and Speech Foundation.

Louise Brooks has been appointed to the staff of Louisiana Polytechnic at Ruston, La., to develop a speech correction program.

Jeanella Roy has been appointed speech therapist for the Lake Charles, Louisiana, School System.

Mildred LaHaye is the newly appointed speech therapist for the Public Schools of Lafayette, Louisiana.

Julia Arnold has been appointed speech therapist for the West Baton Rouge, La., Parish.

Murray M. Halfond has been appointed a member of the Professional Advisory Committee of the United Cerebral Palsy Association of Philadelphia.

Appointments of recent Purdue graduates are as follows: J. Donald Causey, Senior Clinical Audiologist, Board of Health, Washington, D. C.; James D. Lambert, Director, Speech and Hearing Clinic, University of Arizona, Tucson, Arizona; William R. Leith, Assistant Professor at University of Wichita and Senior Clinician, Institute of Logopedics; Harold R. Starbuck, Assistant Professor and Speech Pathologist, Tulane University Medical School; Arthur I. Weiss, Director, Rehabilitation Center, Spartenberg, South Carolina. George Shaffer has been promoted to Associate Professor on the staff of the Purdue Speech and Hearing Clinic. Mack Steer has been appointed as a member of the Committee on Industrial Noise of the Indiana State Medical Association.

John Crawford has been appointed Assistant Professor of Speech and a member of the Speech Clinic staff at the College of the Pacific, Stockton, California.

Harold Luper has joined the staff of the University of Georgia as Assistant Professor of Speech Correction.

Claude S. Hayes has been elected Director of Education of the Junior League School for Speech Correction, Atlanta, Georgia, and has been appointed to the Graduate Faculty of Emory University.

Carol Raffman has been added to the staff of the speech therapy section of the Cerebral Palsy Center at Ridgewood, New Jersey.

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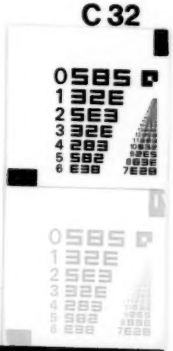
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